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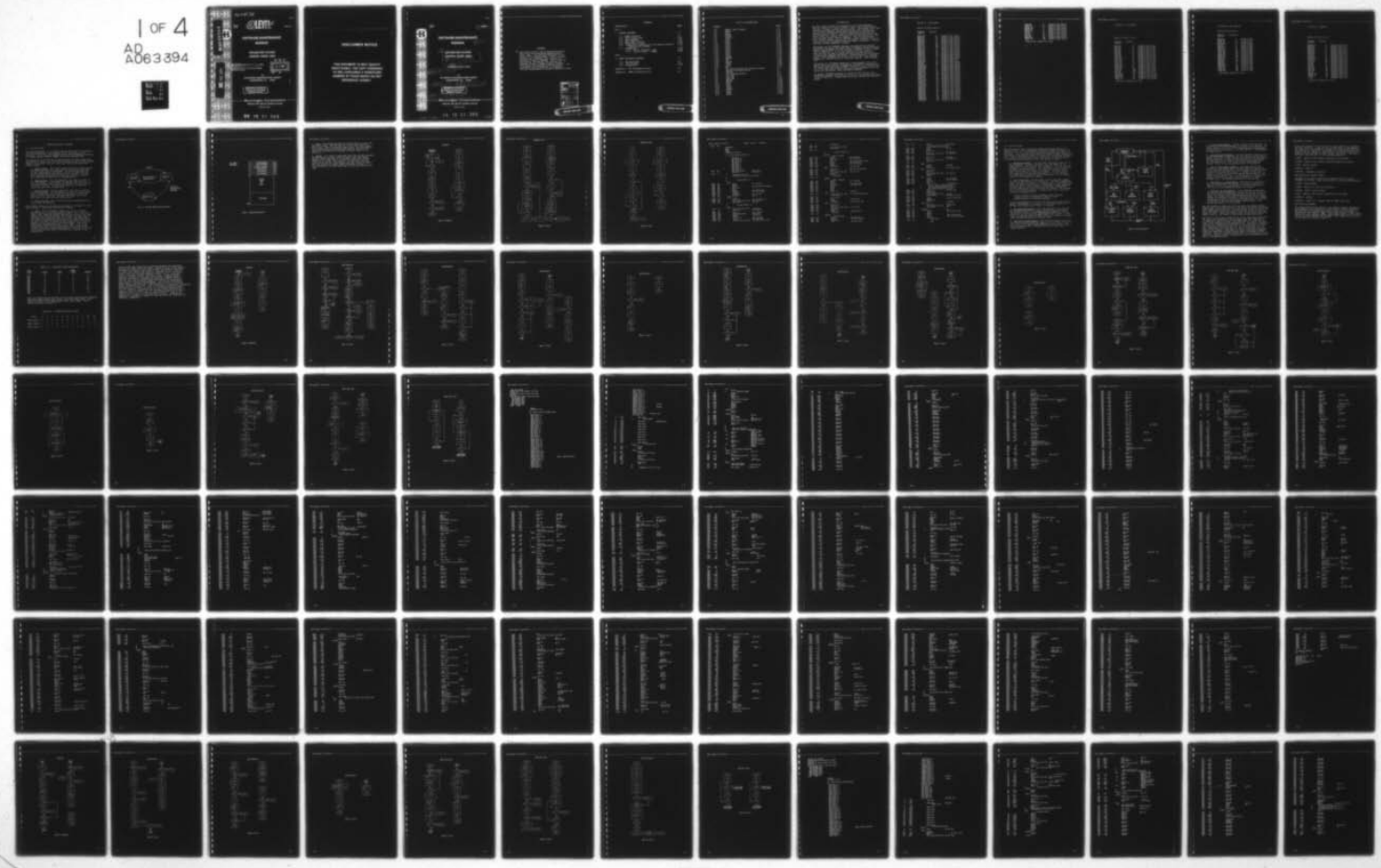

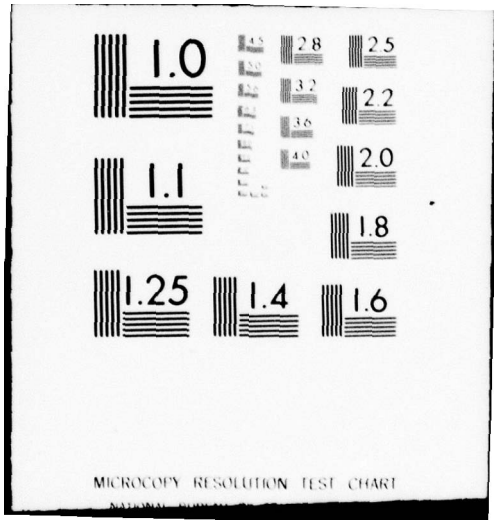
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BOOK 2
MDMPL

(11) NU LEVEL III

APRIL 1977

SOFTWARE MAINTENANCE MANUAL

EXPLORATORY SYSTEMS CONTROL MODEL (ESM)

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BOOK 2
MDMPL

(11) APRIL 1977

SOFTWARE MAINTENANCE MANUAL

(12) 317 p.

(6) EXPLORATORY SYSTEMS CONTROL MODEL (ESM).
Software Maintenance Manual. Book 2. MDMPL.

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FOREWORD

This publication is the Software Maintenance Manual for the Exploratory Systems Control Model (ESM). The software described is contained on four system tapes. Book 1 contains description, flowcharts, and listings for programs written in FORTRAN. Book 2 contains description, flowcharts, and listings for programs written in MDMPL Assembly Language. This manual was prepared by the Burroughs Corporation and is submitted in accordance with the requirements of contract DCA100-75-C-0054.

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Introduction

The ESM system software is contained on four TU10 Magtapes. Tape #1 contains the source, object, task, overlay description language, message, system, ATEC simulation, and command files used for the User Language, Record Move Utility, and Interprocess Communication and Resource Sharing Demonstration Programs for host processors A and B. Tape #2 contains microcode source and object files for loading the eleven B7* CIE microprocessors, and the microcode loader utility (ESMLDR). Tape #3 contains the task, source, object, and overlay description language files for the Mini-D Micro Programming Language (MDMPL) Assembler. Tape #4 contains the ESM Diagnostic Library.

References for the FORTRAN language used include the Digital Equipment Corporation documents PDP-11 FORTRAN Language Reference Manual (DEC-11-CFLRA-C-D) and IAS/RSX-11 FORTRAN IV User's Guide (DEC-11-LMFUA-C-D). It is also assumed that the reader is familiar with the PDP-11 RSX11M operating system (Version 2) including MCR commands (Reference - RSX11M Operator's Procedures Manual - DEC-11-OM06A-B-D) and the utilities EDI, FLX, and PIP (Reference - RSX11M Utilities Procedures Manual - DEC-11-OMOGA-B-D).

References for the MDMPL Assembler include Appendix A of this manual which provides B7* programming information, Appendix B of the manual which provides an MDMPL Instruction List, and Section 4.6 of the ESM User's Manual which describes Assembler use, CIE Instruction Functions, and programming examples.

In general, FORTRAN programs are stored in UIC [20,20], CIE Microcode programs are stored in UIC[1,20], and Diagnostics are stored in UIC[1,4]. System Tape Directory Listings are presented below.

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ESM TAPE #1 - USER LANGUAGE

```
MCR>FLX TT0:=MT0:[*,*]*.*/LI

DIRECTORY       MT0:[0,0]
18-MAR-77

RCMV1.FOR              9.     18-MAR-77 <233> [20,20]
RCMV1.OBJ             22.     18-MAR-77 <233> [20,20]
RCMV1.ODL              1.     18-MAR-77 <233> [20,20]
RCMV1.TSK             53.     18-MAR-77 <233> [20,20]
RCMV5.ODL              1.     18-MAR-77 <233> [20,20]
RCMV5.FOR              9.     18-MAR-77 <233> [20,20]
RCMV5.TSK             53.     18-MAR-77 <233> [20,20]
RCMV5.OBJ             22.     18-MAR-77 <233> [20,20]
PROC1.TSK             48.     18-MAR-77 <233> [20,20]
PROC1.OBJ             26.     18-MAR-77 <233> [20,20]
PROC1.ODL              1.     18-MAR-77 <233> [20,20]
PROC1.FOR             11.     18-MAR-77 <233> [20,20]
PROC5.OBJ             27.     18-MAR-77 <233> [20,20]
PROC5.ODL              1.     18-MAR-77 <233> [20,20]
PROC5.TSK             48.     18-MAR-77 <233> [20,20]
PROC5.FOR             11.     18-MAR-77 <233> [20,20]
M1710.FOR              1.     09-MAR-77 <233> [20,20]
M1710.OBJ              1.     09-MAR-77 <233> [20,20]
M1710.TSK              3.     09-MAR-77 <233> [1,1]
M1710.STB              1.     09-MAR-77 <233> [1,1]
INFOPM.OBJ            67.     09-MAR-77 <233> [20,20]
MSG.OBJ               36.     09-MAR-77 <233> [20,20]
EFTERD.OBJ             9.     09-MAR-77 <233> [20,20]
EFCKTD.OBJ             4.     09-MAR-77 <233> [20,20]
EFTRKD.OBJ             4.     09-MAR-77 <233> [20,20]
EFLOCF.OBJ             5.     09-MAR-77 <233> [20,20]
EFDIR.OBJ              2.     09-MAR-77 <233> [20,20]
STESM.CMD              1.     09-MAR-77 <233> [20,20]
ESMLDR.TSK            32.     09-MAR-77 <233> [20,20]
MDMPL.TSK             86.     09-MAR-77 <233> [20,20]
USROVL.ODL             1.     09-MAR-77 <233> [20,20]
P0000.OBJ             21.     09-MAR-77 <233> [20,20]
P0000.FOR             11.     09-MAR-77 <233> [20,20]
P00001.OBJ            21.     09-MAR-77 <233> [20,20]
P00001.FOR            11.     09-MAR-77 <233> [20,20]
P1000.FOR              6.     18-MAR-77 <233> [20,20]
P1000.OBJ             12.     18-MAR-77 <233> [20,20]
P10001.FOR             6.     18-MAR-77 <233> [20,20]
P10001.OBJ            12.     18-MAR-77 <233> [20,20]
P2000.FOR              5.     18-MAR-77 <233> [20,20]
P2000.OBJ             11.     18-MAR-77 <233> [20,20]
P3000.FOR             11.     18-MAR-77 <233> [20,20]
P3000.OBJ             26.     18-MAR-77 <233> [20,20]
P3001.OBJ             17.     18-MAR-77 <233> [20,20]
P3001.FOR              7.     18-MAR-77 <233> [20,20]
P4000.FOR             13.     18-MAR-77 <233> [20,20]
P4000.OBJ             29.     18-MAR-77 <233> [20,20]
P40001.FOR            13.     18-MAR-77 <233> [20,20]
P40001.OBJ            29.     18-MAR-77 <233> [20,20]
P4001.FOR             11.     18-MAR-77 <233> [20,20]
```

```
P5000.FOR                 4.      18-MAR-77 <233> [20,20]
P5000.OBJ                 8.      18-MAR-77 <233> [20,20]
RDLOOP.OBJ                2.      18-MAR-77 <233> [20,20]
RDLOOP.FOR                1.      18-MAR-77 <233> [20,20]
WRLOOP.FOR                1.      18-MAR-77 <233> [20,20]
WRLOOP.OBJ                2.      18-MAR-77 <233> [20,20]
HST.FOR                   4.      18-MAR-77 <233> [20,20]
HST.OBJ                   11.     18-MAR-77 <233> [20,20]
HST1.FOR                  4.      18-MAR-77 <233> [20,20]
HST1.OBJ                  11.     18-MAR-77 <233> [20,20]
USRLN5.TSK                98.     18-MAR-77 <233> [20,20]
USRLN1.TSK                98.     18-MAR-77 <233> [20,20]

 TOTAL OF 1181. BLOCKS IN 65. FILES

>
```

ESM TAPE #2 - CIE MICROCODE

```
MCR>FLX TT1:=MT0:[*,*]*.*/LI

DIRECTORY       MT0:[0,0]
12-MAR-77

HST1.OBJ                9.      12-MAR-77 <233> [1,20]
GAT2.OBJ                8.      12-MAR-77 <233> [1,20]
GAT3.OBJ                8.      12-MAR-77 <233> [1,20]
CRT4.OBJ                9.      12-MAR-77 <233> [1,20]
HST5.OBJ                9.      12-MAR-77 <233> [1,20]
GAT6.OBJ                8.      12-MAR-77 <233> [1,20]
GAT7.OBJ                8.      12-MAR-77 <233> [1,20]
CRT8.OBJ                9.      12-MAR-77 <233> [1,20]
HST9.OBJ                8.      12-MAR-77 <233> [1,20]
GAT10.OBJ               8.      12-MAR-77 <233> [1,20]
GAT11.OBJ               8.      12-MAR-77 <233> [1,20]
HST1L.OBJ               9.      12-MAR-77 <233> [1,20]
CRT4L.OBJ               9.      12-MAR-77 <233> [1,20]
HST5L.OBJ               9.      12-MAR-77 <233> [1,20]
CRT8L.OBJ               9.      12-MAR-77 <233> [1,20]
CRT4S.OBJ               9.      12-MAR-77 <233> [1,20]
CRT8S.OBJ               9.      12-MAR-77 <233> [1,20]
HST9S.OBJ               8.      12-MAR-77 <233> [1,20]
CRT4.DAT              119.      12-MAR-77 <233> [1,20]
HST5.DAT              100.      12-MAR-77 <233> [1,20]
GAT7.DAT               97.      12-MAR-77 <233> [1,20]
HST9.DAT              102.      12-MAR-77 <233> [1,20]
ESMLDR.FOR              2.      12-MAR-77 <233> [20,20]
ESMLDR.OBJ              5.      12-MAR-77 <233> [20,20]
ESMLDR.TSK             32.      12-MAR-77 <233> [20,20]
MDMPL.TSK              86.      12-MAR-77 <233> [20,20]

 TOTAL OF 697. BLOCKS IN 26. FILES

>
```

ESM TAPE #3 - MDMPL ASSEMBLER

```
FLX>CLO:=MT0:[20,20]*.*/LI

DIRECTORY       MT0:[20,20]
26-FEB-77

FASS.ODL                1.     26-FEB-77 <233>
MDMLST.CMD              1.     26-FEB-77 <233>
SUSAN.FOR              13.     26-FEB-77 <233>
BLOCK.FOR               3.     26-FEB-77 <233>
RESCAN.FOR              7.     26-FEB-77 <233>
WRT.FOR                 9.     26-FEB-77 <233>
SQUASH.FOR              3.     26-FEB-77 <233>
SCAN.FOR                5.     26-FEB-77 <233>
COLUMN.FOR              7.     26-FEB-77 <233>
CONDIT.FOR             11.     26-FEB-77 <233>
LITRL.FOR              13.     26-FEB-77 <233>
LOGIC.FOR              16.     26-FEB-77 <233>
LOGICA.FOR             13.     26-FEB-77 <233>
MDMPL.TSK              86.     26-FEB-77 <233>
SUSAN.OBJ              27.     26-FEB-77 <233>
BLOCK.OBJ               1.     26-FEB-77 <233>
RESCAN.OBJ             10.     26-FEB-77 <233>
WRT.OBJ                11.     26-FEB-77 <233>
SQUASH.OBJ              3.     26-FEB-77 <233>
SCAN.OBJ                7.     26-FEB-77 <233>
COLUMN.OBJ             11.     26-FEB-77 <233>
CONDIT.OBJ             23.     26-FEB-77 <233>
LITRL.OBJ              23.     26-FEB-77 <233>
LOGIC.OBJ              38.     26-FEB-77 <233>
LOGICA.OBJ             38.     26-FEB-77 <233>

 TOTAL OF 380. BLOCKS IN 25. FILES

>
```

ESM TAPE #4 - DIAGNOSTICS

```
MCR>FLX TT1:=MT0:[*,*]*.*/LI

DIRECTORY       MT0:[0,0]
10-MAR-77

MEMCK0. OBJ              2.      26-FEB-77 <233> [1,4]
BLOUT. OBJ               2.      26-FEB-77 <233> [1,4]
LPCK0. OBJ               2.      26-FEB-77 <233> [1,4]
GTB0. OBJ                1.      26-FEB-77 <233> [1,4]
CRTOBJ. OBJ              2.      26-FEB-77 <233> [1,4]
PDP0. OBJ                1.      26-FEB-77 <233> [1,4]
GTB0A. OBJ               1.      26-FEB-77 <233> [1,4]
CTCG0. OBJ               2.      26-FEB-77 <233> [1,4]
PDP. OBJ                 6.      26-FEB-77 <233> [1,4]
CTCC0. OBJ               3.      26-FEB-77 <233> [1,4]
CONMEM. OBJ              5.      26-FEB-77 <233> [1,4]
BLKS. DAT                9.      26-FEB-77 <233> [1,4]
MEMCK. DAT              10.      26-FEB-77 <233> [1,4]
LPCK. DAT                8.      26-FEB-77 <233> [1,4]
PDP. DAT                 4.      26-FEB-77 <233> [1,4]
GTB. DAT                 4.      26-FEB-77 <233> [1,4]
GTBA. DAT                5.      26-FEB-77 <233> [1,4]
CTCG. DAT               11.      26-FEB-77 <233> [1,4]
CTCC. DAT               23.      26-FEB-77 <233> [1,4]
CRTCK. DAT              21.      26-FEB-77 <233> [1,4]
PDP. FOR                 3.      26-FEB-77 <233> [1,4]
PDP. TSK                31.      26-FEB-77 <233> [1,4]
CONMEM. FOR              2.      26-FEB-77 <233> [1,4]
CONMEM. TSK             32.      26-FEB-77 <233> [1,4]
TI. DAT                  5.      10-MAR-77 <233> [1,4]
TI. OBJ                  1.      10-MAR-77 <233> [1,4]

 TOTAL OF 196. BLOCKS IN 26. FILES

>
```

2. MDMPL Microcode Programs

2.1 NCU Microcode

The program running in the Nodal Control Unit (B7*) is contained on three PROM chips. This program is not alterable by user personnel. Note that the program listing uses hexadecimal notation for memory program address (MPAD) and 12-bit instructions.

The operation of the NCU may be described by the three-state diagram shown in Figure 2-1. The NCU is always in one of three states; namely: Read, Wait or Write. The state transitions and their causes follow:

1. Read-to-wait. This state transition occurs when a packet has been read into the input page of the NCU as indicated by the end-of-packet word (EOP). The NCU informs the CIE of this condition by setting the EXT of the CIE. The NCU then suspends operation by waiting for its EXT to be set. The read-to-wait transition is unconditional.

2. Wait-to-read. The CIE determines the type of packet in the input page. If the packet is neither a WT nor a receive/ send type, the CIE sets the mailbox for read and sets the EXT of the NCU. The NCU then comes out of the Wait state and goes into its Read mode.

3. Wait-to-write. The CIE determines the type of packet in the input page. If the packet is a WT or a receive/send type, the CIE sets the mailbox for the type of write and sets the EXT of the NCU. The NCU then comes out of the Wait state and goes into the Write state.

4. Write-to-read. This transition occurs unconditionally after write is complete.

The software modules of the NCU are written to correspond to the three states; a functional description follows:

1. Read. The LIU address register is set to the read address given in the mailbox page (Figure 2-2.) When the nodal logic senses an address word that is equal to the read address, the information word that follows is read into the input page and the B-register of the NCU. The data words are read into sequential locations of the input page until the EOP (all ONEs) is sensed in the B-register by an IF ABT command in the read loop of the NCU program. The information word following the EOP is also read. This is the longitudinal parity check (LPC) word. Exit to the read-to-wait routine is then performed wherein the EXT of the CIE is set and the Wait state is entered by a looping IF EXT instruction.

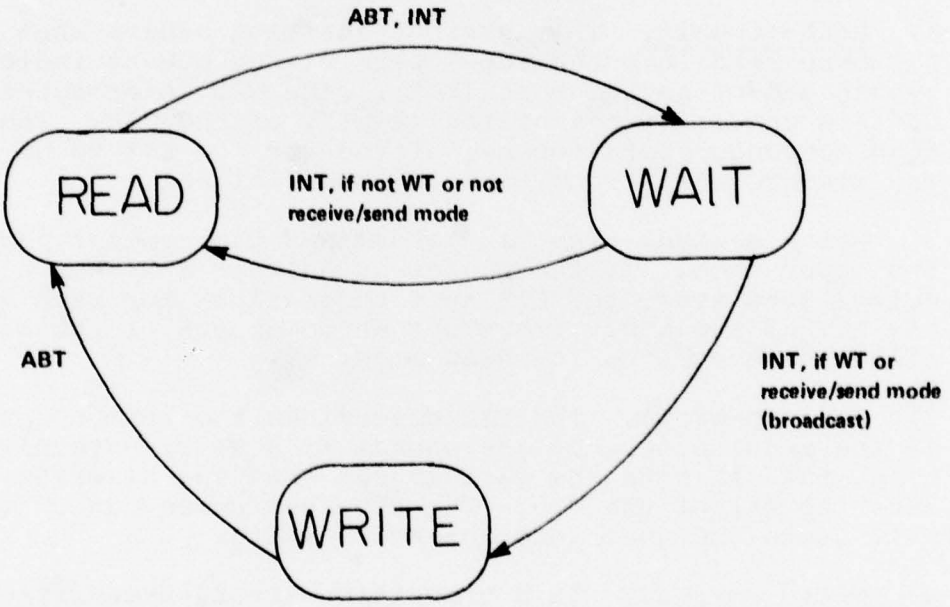


Figure 2-1. NCU State Diagram and Software Module

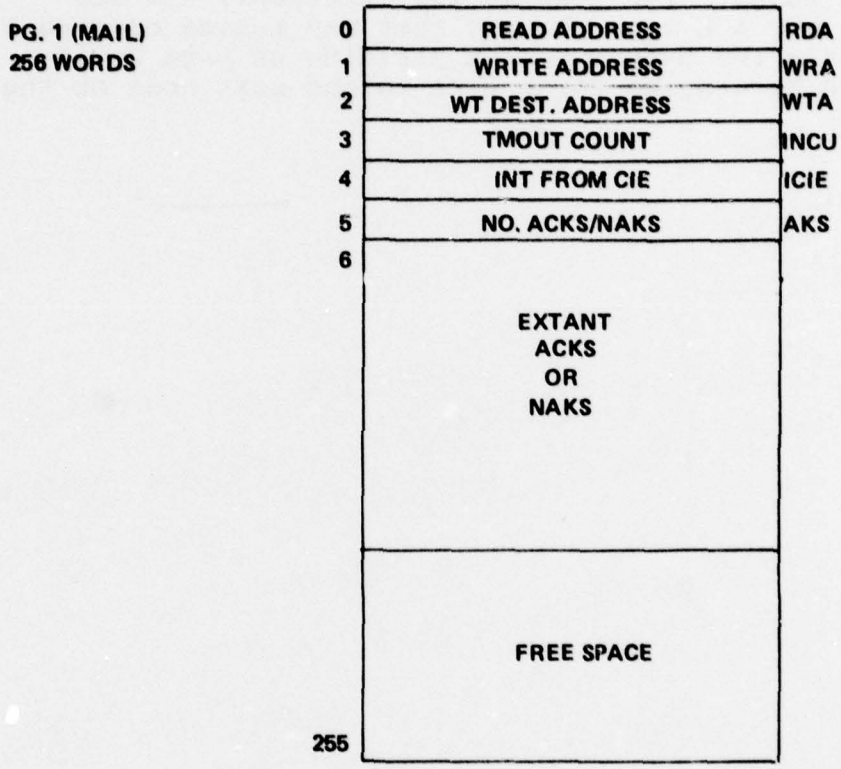


Figure 2-2. Mailbox Page Description

2. Wait. This module allows the CIE and NCU to access the same data pages. The NCU dwells in this state until its EXT is set. When an interrupt does occur, the NCU examines the mailbox page to determine what type of interrupt has occurred. The possible interrupts are Read, Write 0, or Write 1,2.

3. Write. If a Write 0 interrupt from the CIE has occurred, the NCU writes the data words of page 0 with the proper address field indicated on its mailbox page until an EOP character is found. For a Write 1,2 interrupt, the NCU first writes any ACK type packets that may reside on page 1 and then writes the output packet residing on page 2, if any, followed by a write token sent to the next node on the loop.

ESM/NCU

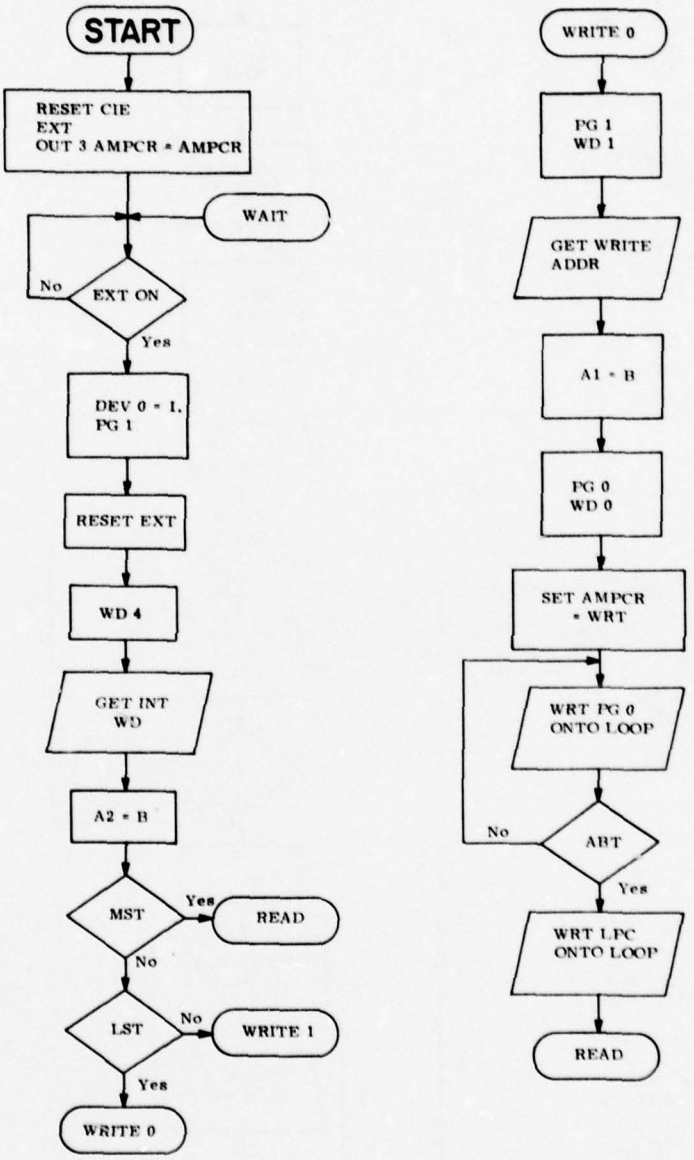


Figure 2-3. ESM/NCU

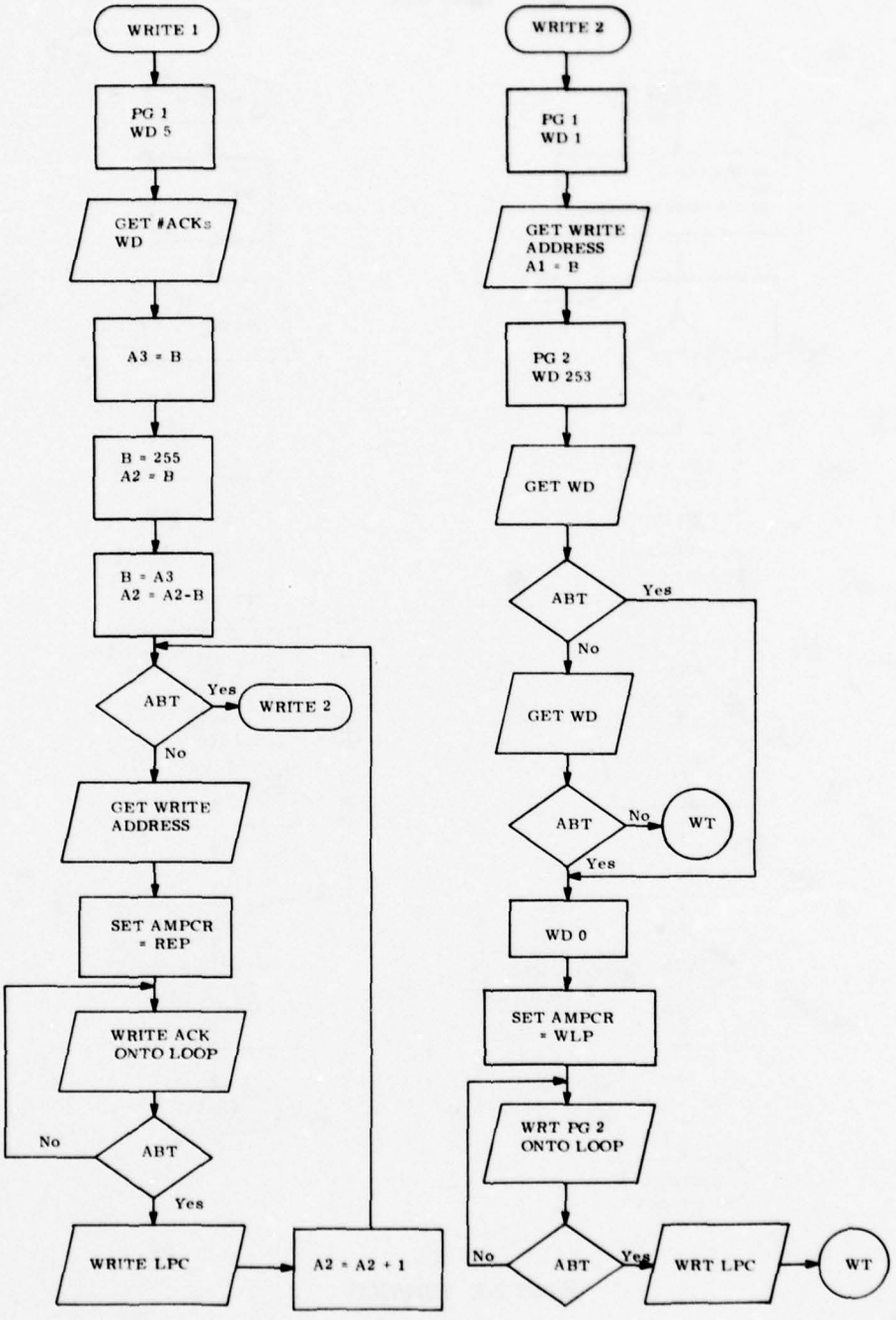


Figure 2-3. (Cont.)

ESM/NCU (cont.)

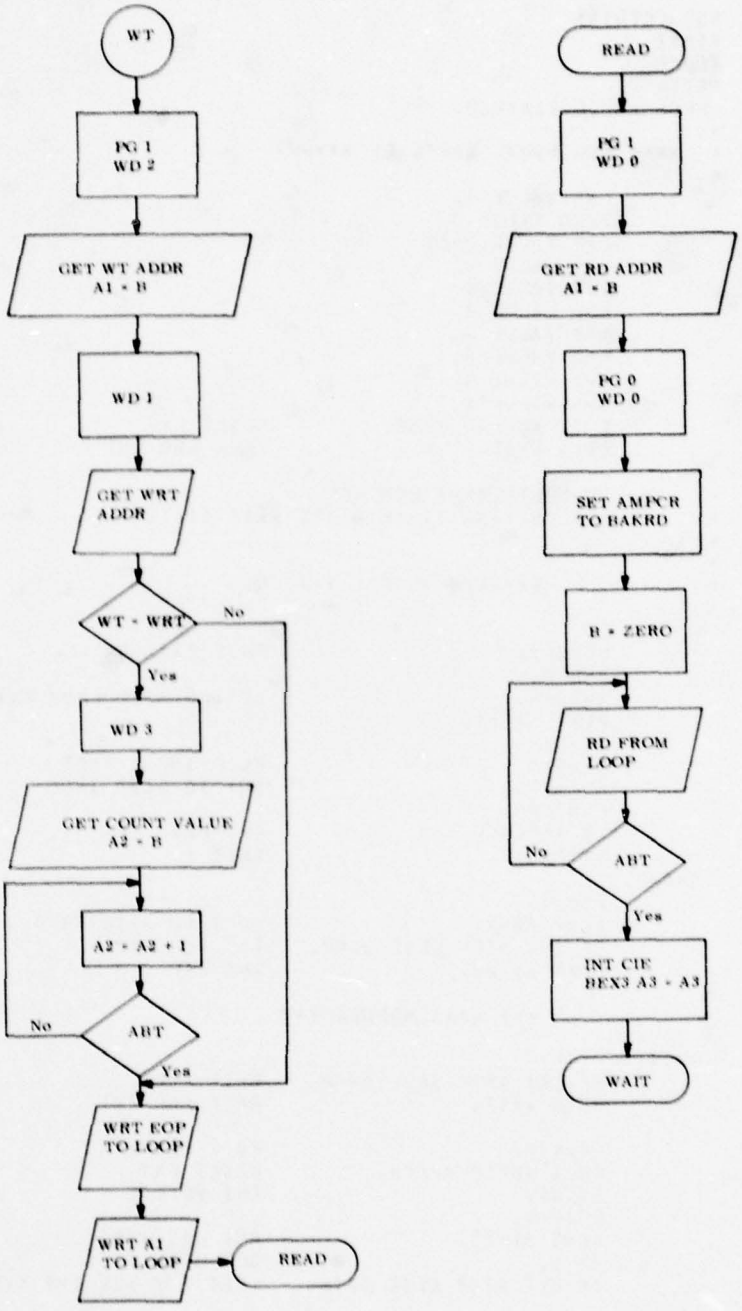


Figure 2-3. (Cont.)

```
MCMPL ASSEMBLER (10/14/76)                    MONDAY  03/21/77   10:33:28

   PPAD   CODE
                    $OBJECTDISK
                    $8BIT
                    $CODE
                    $BITS
                     PROGRAM-ID ESM/NCU.
                    *
                    *   **** NCU NODAL SOFTWARE ****
                    *
                           ONE VALUE 1.
                           ZERO VALUE 0.
                           EOP VALUE 255.
                           NN0 VALUE 0.
                           NN1 VALUE 1.
                           NN2 VALUE 2.
                           NN3 VALUE 3.
                           NN4 VALUE 4.
                           NN5 VALUE 5.
                           NN6 VALUE 6.
   00C0   0DD              CUT3 AMPCR=AMPCR.          RESET EXT
                           GOTO WAIT.                  FOR HRDW INT
   00C1   **E
                    *       USED TO SHUT OFF NCU
                    *       BY PUTTING IT INTO ITS WAIT STATE
                    *
                    *
                    *            ***READ MODULE ***
                    *
                     READ.
   00C2   010              DEV0=1.                    PG 1 MAILBOX
   00C3   0CB              B=NN0.
   00C4   051              CUT0=B.                    GET RD ADDR FROM MAILBOX
   00C5   4E5              BEX1 A1=A1.
   00C6   045              A1=B.
   00C7   0C0              DEV0=0.                    PG 0 INPUT PAGE
   00C8   351              CUT0=0.                    SET TO READ INTO
   00C9   **B              B=BAKRD.
   00CA   07D              A3 AMPCR=B.                SET FOR JUMP
   00CB   00B              B=ZERO.                    INIT B
                     BAKRD.
   00CC   4C5              A1=A1.
   00CD   069              BEX2 A2=B.                 RD I WD INTO PG 0
   00CE   78F              IF ABT STEP ELSE JUMP.     TST FOR RECP
   00CF   CED              BEX3 A3=A3.                INT CIE
                    *
                    *            *** WAIT MODULE ***
                    *
                     WAIT.
   0010   FC7              IF EXT SKIP ELSE STEP.     WAIT LOOP
                           GOTO WAIT.                 WAIT FOR EXT
   0011   1CE
   0012   010              DEV0=1.                    PG 1 MAILBOX
   0013   0DD              CUT3 AMPCR=AMPCR.          RESET EXT
   0014   04B              B=NN4.                     INT WD LOC
   0015   051              CUT0=B.
   0016   4E5              BEX1 A1=A1.                GET INT WORD
   0017   049              A2=B.                      SET COND F/FS
   0018   197              IF MST STEP ELSE SKIP.     TEST FOR CIE INT TYPE
```

```
                        GOTO READ.
C019   02E
001A   5C7              IF LST SKIP ELSE STEP.
                        GOTO WRITE1.
0018   **E
                *
                *           *** WRITE MODULE ***
                *
                WRITE0.
                *           WRITE 0 ROUTINE
C01C   010              DEV0=1.                 PG 1 MAILBOX
C01D   091              OUT0=1.                 GET WRITE ADDR
C01E   4E5              BEX1 A1=A1.
C01F   045              A1=B.                   LD A1 REG WITH WRT ADDR
0020   000              DEV0=0.                 PG 0 INPUT PG
0021   351              OUT0=0.                 SET FOR 01H WRD
0022   **B              B=WRT.
0023   07D              A3 AMPCR=B.             SET FOR JUMP
                WRT.
0024   4E5              BEX1 A1=A1.             WRITE PG 0 ONTO LOOP
0025   059              OUT2=B.
0026   78F              IF ABT STEP ELSE JUMP.  TST FOR REP
0027   4E5              BEX1 A1=A1.
0028   059              OUT2=B.
                            GOTO READ.
C029   02E
                WRITE1.
                *           WRITE 1 ROUTINE
C02A   010              DEV0=1.                 PG 1 MAILBOX
002B   058              B=ANS.
002C   051              OUT0=B.                 GET #ACKS WORD
002D   4E5              BEX1 A1=A1.              SET #ACKS CTR
002E   040              A3=B.
002F   FFB              B=EOP.
0030   049              A2=B.
0031   CC1              B=A3.
0032   989              A2=A2 - B.              A2=255-A2
                ACK.
0033   797              IF ABT STEP ELSE SKIP.  E IT WHEN NO MORE ACKS
                          GOTO WRITE2.
0034   **E
0035   4E5              BEX1 A1=A1.
0036   045              A1=B.                   LOAD INTO A1
0037   **B              B=REP.
0038   07D              A3 AMPCR=B.             SET FOR LOOP JUMP
                REP.
0039   4E5              BEX1 A1=A1.
003A   059              OUT2=B.
003B   78F              IF ABT STEP ELSE JUMP.  TST FOR REP
003C   4E5              BEX1 A1=A1.
003D   059              OUT2=B.
003E   889              A2=A2 + 1.              INC #ACKS CTR
                          GOTO ACK.
003F   33E
                WRITE2.
                *           WRITE2 ROUTINE
0040   010              DEV0=1.                 PG 1 MAILBOX
0041   091              OUT0=1.                 GET WRITE ADDRESS
0042   4E5              BEX1 A1=A1.
0043   045              A1=B.                   LD INTO A1 REG
```

```
C044   020                DEVO=2.                    PG 2 OUTPUT
                  *        CK IF LOCS 253 OR 254 ON PG 2
                  *        =EOP BEFORE WRITING OUT PG 2
C045   FDB                B=253.                     253 WD
0046   051                OUTO=B.
0047   4E5                BEX1 A1=A1.
0048   041                B=B.                       SET COND F/FS
0049   797                IF ABT STEP ELSE SKIP.     TST FOR EOP
                          GOTO PREP.
C04A   **E
C04B   4E5                BEX1 A1=A1.                254TH WD
C04C   041                B=B.                       SET COND F/FS
C04D   7C7                IF ABT SKIP ELSE STEP.
                          GOTO WT.
C04E   **E
                  PREP.
004F   351                OUTO=0.                    0TH WORD
0050   **B                B=WLP.
0051   07D                A3 AMPCR=B.                SET FOR LOOP JUMP
                  WLP.
0052   4E5                BEX1 A1=A1.
0053   059                OUT2=B.
0054   78F                IF ABT STEP ELSE JUMP.     TST FOR EOP
0055   4E5                BEX1 A1=A1.
0056   059                OUT2=B.
                  WT.
C057   010                DEVO=1.                    PG 1 MAILBOX
0058   02B                B=NN2.                     GET WT ADDRESS
0059   051                OUTO=B.
C05A   4E5                BEX1 A1=A1.
C05B   045                A1=B.                      LD INTO A1 REG
                  *         CK IF WT ADDR IS SAME AS WRT ADDR.
                  *         IF YES, LEAVE SUFFICIENT SPACE
                  *         FOR TWO CONSECUTIVE PACKET READS.
                  *         GET COUNT VAR FROM PG 1, LOC 3
005C   091                OUTO=1.                    GET WRT ADDR
005D   4E5                BEX1 A1=A1.
005E   50D                A3=A1 EQV B.
005F   7C7                IF ABT SKIP ELSE STEP.     WT=WRT?
                          GOTO NOSPACE.              NO,SPACE NOT NECESS
C060   **E
C061   03B                B=NN3.                     YES,GET COUNT VALUE
C062   051                OUTO=B.
0063   4E5                BEX1 A1=A1.
0064   049                A2=B.                      A2=VCOUNT
                  CNTLP.
C065   889                A2=A2 + 1.                 INCR VCOUNT
C066   7C7                IF ABT SKIP ELSE STEP.     =255?
                          GOTO CNTLP.                NO
C067   65E
                  NOSPACE.                           YES
0068   FFB                B=EOP.                     WRT WT EOP TO LOOP
0069   4C5                A1=A1.
C06A   059                OUT2=B.
C06B   187                STEP.                      CHAR. SPACE TIMING
C06C   4C5                A1=A1.                      WRT WT LFC=A1 TO LOOP
006D   4D9                OUT2=A1.
                               GOTO READ.
C06E   02E
                              END?
```

2.2 CIE Microcode

The CIE software that implements address-directed protocols is definable as a set of ten modules squenced as shown in Figure 2-4. Modules on the left have higher selection priority than those on the right. This provides the quickest NCU wait-to-read transitions which must be performed rapidly to ensure that no message destined for a node is missed owing to late transition to the Read state. A short functional description for each module follows.

1. Background Module. The CIE scans the events that are to be processed. If none is present, the CIE looks for an empty external input buffer (for transfer of data to external equipment - such as host or user terminal, or in the case of gateway nodes another CIE). It loads the external buffer from input queue if a packet is present. It looks for an EXT interrupt from the interface buffer. It also handles the generation of new WT's and checks packets in the output queue for retransmission timeout.

2. Node Controller. An NCU event occurs only upon completion of an NCU read-to-wait transition. The NODE CONTROLLER moves the packet on page 0 to an empty page in CIE memory and links the page to input queue. The header is then examined. For ACK, NAK or input messages the NCU READ INTERRUPTER is started immediately with one exception; namely: the message is a nodal control message. In that case, one of the following is performed first.

   - Write mailbox to change hardware (read) address;
   - Change logical-ID/functional address table;
   - Write mailbox to change WT address.

   If the input packet is of the receive/send type then the NCU WRITE 0 INTERRUPTER is started. If the input packet is a WT then the output queue handler is started.

3. NCU Read Interrupter. The read mailbox is set and the EXT of the NCU is set to cause a wait-to-read transition. For ACK/NAK inputs, the OUTSTANDING ACK HANDLER is called, otherwise the CIE TO INPUT QUEUE HANDLER is called. If the node is a gateway node, ACK/NAK inputs are treated as regular input messages destined for another loop.

4. NCU Write 0 Interrupter. The Write 0 mailbox is set and the EXT of the NCU is set to cause a wait-to-write transition. The CIE TO INPUT QUEUE HANDLER is then called. Thus a receive/send message is treated as both an input and an output message.

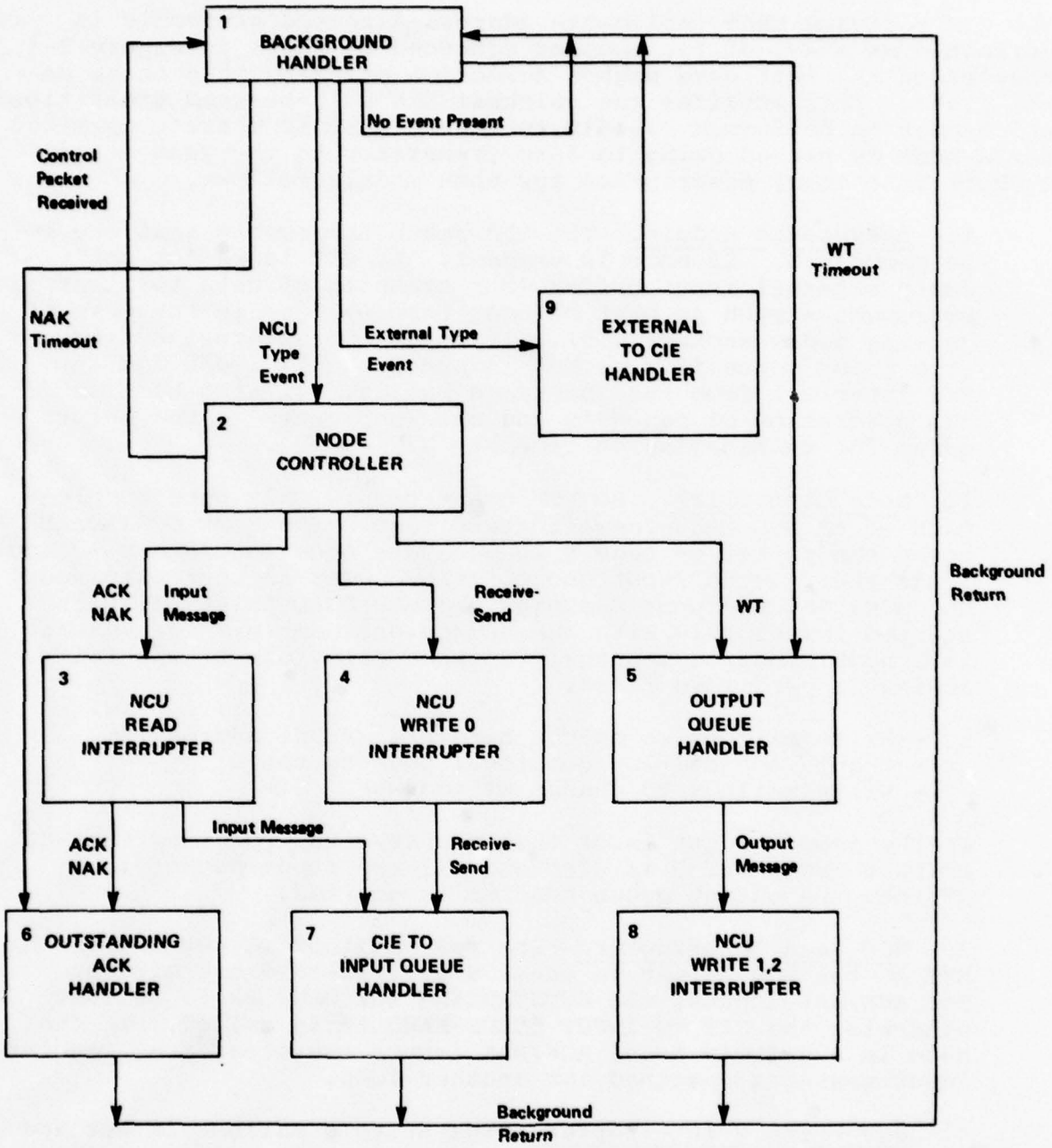


Figure 2-4. CIE Software Manual

5. Output Queue Handler. After a WT has been received, all extant output ACK/NAK messages are moved to the mailbox. An output message (if any) is then delinked from Output Queue and moved to the NCU page 2. The NCU WRITE 1, 2 INTERRUPTER is then called.

6. Outstanding ACK Handler. An ACK received is paired to a packet previously written to the line and the packet page is marked available. A NAK received is paired to a previously written page and the page is relinked to the Output Queue for retransmission. At the end of the Outstanding ACK module, return to the Background module is performed.

7. CIE to Input Queue Handler. All input packets are handled by this module except ACK/NAK packets received at local nodes and WT packets. Input message and receive/send packets are checked for parity. If parity checks, the packet is linked to Input Queue and an ACK is added to the extant output ACK/NAK list. If parity does not check, the packet is marked null and a NAK is added to the extant ACK/NAK list. The Background module is then called.

8. NCU Write 1, 2 Interrupter. The Write 1, 2 mailbox is set. The destination for WT and the output message write address are set into the mailbox. The EXT of the NCU is then set, and the Background handler is called.

9. External to CIE Handler. If an external to CIE event exists, the CIE transfers the content of the CIE buffer to the Output Queue for messages and the CIE buffer is marked empty. In gateway nodes, ACK/NAK packets may also be sent across the external interface. When received, such ACK/NAK messages are placed in the extant ACK/NAK list for transfer to the NCU at the next used Output Queue Handler. The background module is then called.

The CIE program listings use octal notation for memory program address and 12-bit instructions. CIE source and object microcode files reside on ESM Tape #2. Although object files are given for the 11 ESM nodes, only four source files are given for the four types of nodes. These four source files can be used to generate object files for all nodes in the system as described below.

The source files given correspond to a host type node (HST5.DAT), CRT type node (CRT4.DAT), and a gateway type node (GAT7.DAT). In addition a special source file (HST9.DAT) is listed for the loop 3 host node having node designator 9. The node is currently connected to a modem which connects a Texas Instrument's Silent 700 terminal residing in Paoli, Pa. via a leased line to the ESM. Eventually this node will be used as a gateway node connecting the present 3-loop ESM to a fourth loop being developed under the Exploratory System Control Model Development (ESMD) contract. Thus the listing for HST9.DAT is a preliminary version which will change; further documentation will be presented at the end of the ESMD contract.

Since the programs for the three node types (HOST, CRT, GATEWAY) are very similiar, a complete set of flow charts is presented for HST5.DAT only. The other two programs are flowcharted only where they differ from HST5.DAT. CRT4.DAT is the same as HST5.DAT in modules 0-INIT, 2-CONT, 3-INTRD, 4-INTO, and 5-OUTQ. CRT4.DAT is different from HST5.DAT in the following modules:

1-BACK: Replace code between connections B1 and WTTM.

6-OUTAK: Replace code between connectors NNACK and KLLPAC.

7-INQ: Replace IQLINK.

8-INT1-2: Add B2.

9-EXXCIE: Completely different

Add subroutines LKOTB, LKINB.

GAT7.DAT is the same as HST5.DAT in modules O-INIT, 2-CONT, 3-INTRD, and 4-INTO. They are different in the following modules:

1-BACK: Delete PAKOUT

5-OUTQ: Replace C1 until end of module.

6-OUTAK: Delete entire module.

7-INQ: Replace code between connectors A7 and CSTPP.

8-INT1-2: Add B2.

9-EXXCIE: Insert C2. Replace code at LNKOQ until END.

Add Subroutine AKMVR.

The eleven object files differ in the VALUE statement parameters which appear in the beginning of the program. These parameters are the node's own logical-ID (VOLID) which equals the node designator, read address (VRDA), write token address (VWTA) which equals the write address (VWRA), and maximum number of clock ticks for write token regeneration (VDFFWT). The values used for the eleven nodes are given in Table 2-1.

Table 2-1. CIE Nodal VALUE Parameters

NODE TYPE	VOLID	VRDA	VWRA V. WTA	VDFFWT
HST	1	1	3	7
GAT	2	2	1	4
GAT	3	3	2	12
CRT	4	4	2	12
HST	5	2	1	7
GAT	6	1	3	6
GAT	7	3	4	4
CRT	8	4	3	12
HST	9	3	2	14
GAT	10	2	1	4
GAT	11	1	4	7

There are additional variations for the Logical-ID/Functional Address Conversion Table memory page (Page 1) for the three loops. This page is loaded in the O-INIT module after label INRP5. These values are given in Table 2-2.

Table 2-2. LID/FAD Conversion Table

LID's	1	2	3	4	5	6	7	8	9	10	11
FAD's Loop 1	1	2	3	2	2	2	2	3	3	3	3
FAD's Loop 2	1	1	1	4	2	3	1	3	3	3	3
FAD's Loop 3	1	1	1	2	2	2	2	4	3	2	1

Host and CRT type nodes which originate messages use alternate routing indicators VALT0 and VALT1. Nodes in loop 1 have VALT0=2 and VALT1=3, nodes in loop 2 have VALT0=1 and VALT1=3, and nodes in loop 3 have VALT0=1 and VALT1=2. ESM Tape #2 also contains object files for low speed modeling (ending in "L"), and host A (loop 1) dialogue director (ending in "S"). Since low speed operation results in CIE clock tick periods of approximately 3 seconds, the packet retransmission parameter (VMAXCK) value 41 used for the high and medium speed code results in excessively long waits for packet retransmission. Thus object files HST1L, CRT4L, HST5L, and CRT8L use a VMAXCK value of 5 for a 15 second packet retransmission time. Files CRT4S.OJB and CRT8S.OBJ are used for selecting host processor A (loop 1) as primary dialogue director for the terminal. The Logical-ID for the primary dialogue director is given by VPDDLID and the secondary dialogue directory by VADDLID. Logical-ID 1 is used for host processor A loop 1, and Logical-ID 5 is used for host processor B loop 2. CRT4.OBJ and CRT8.OBJ use VPDDLID=5, VADDLID=1, and CRT4S.OBJ and CRT8S.OBJ use VPDDLID=1, VADDLID=5.

HST5. DAT

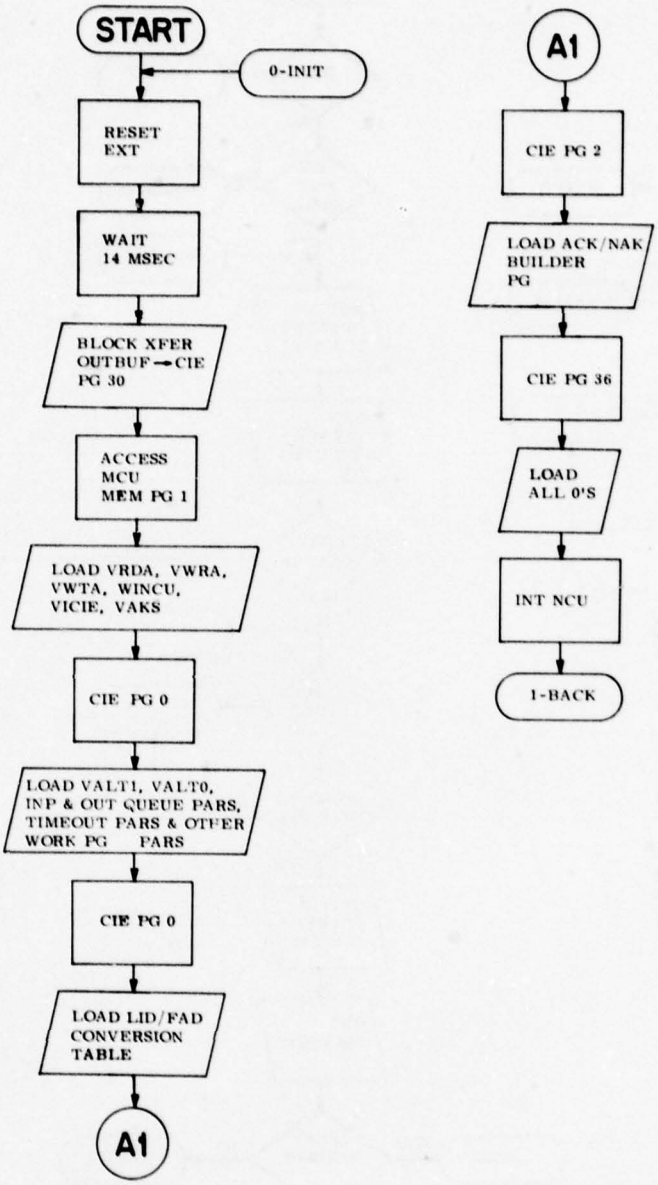


Figure 2-5. HST5.DAT

HST5. DAT (Cont.)

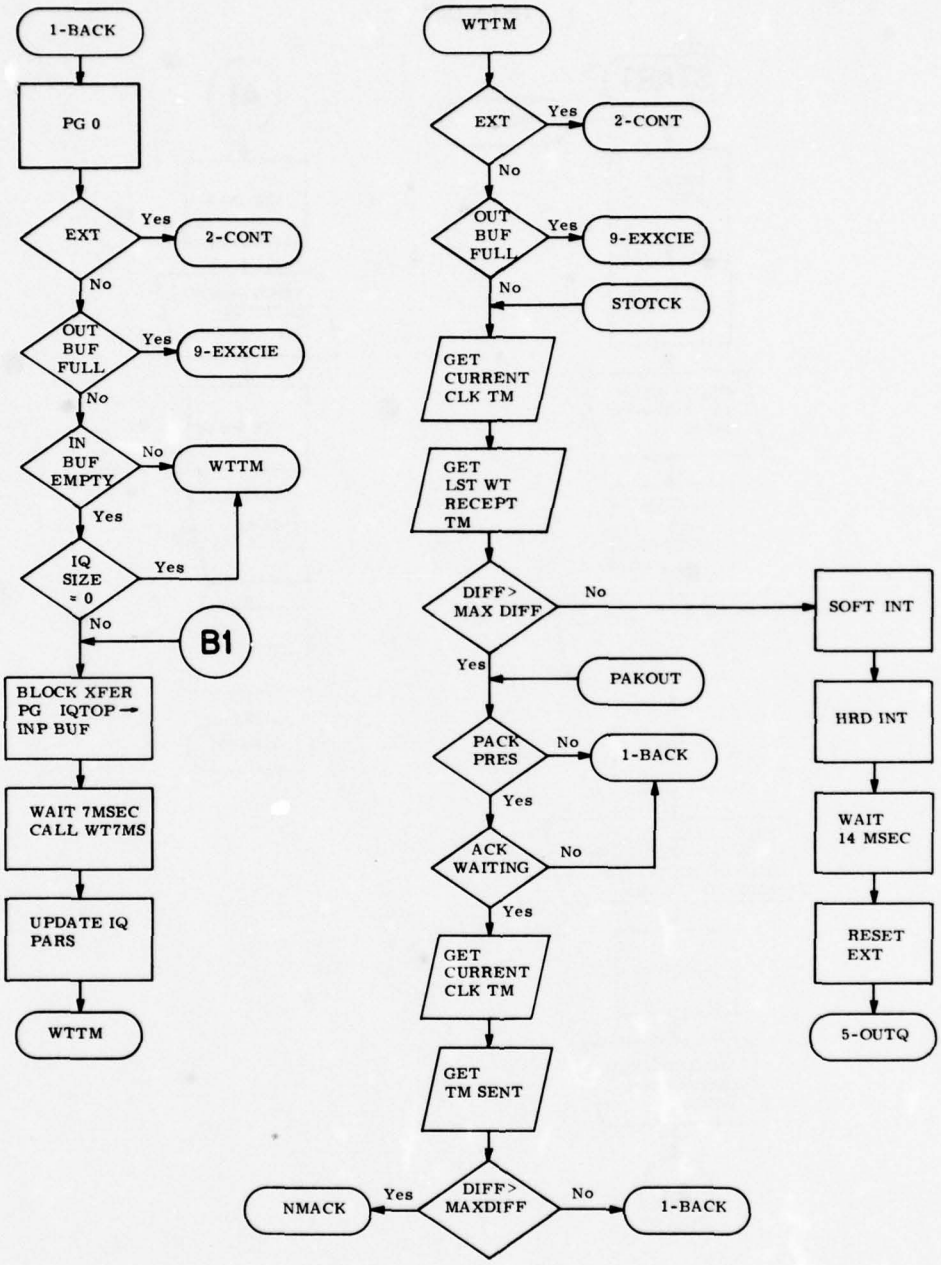


Figure 2-5. (Cont.)

HST5. DAT (Cont.)

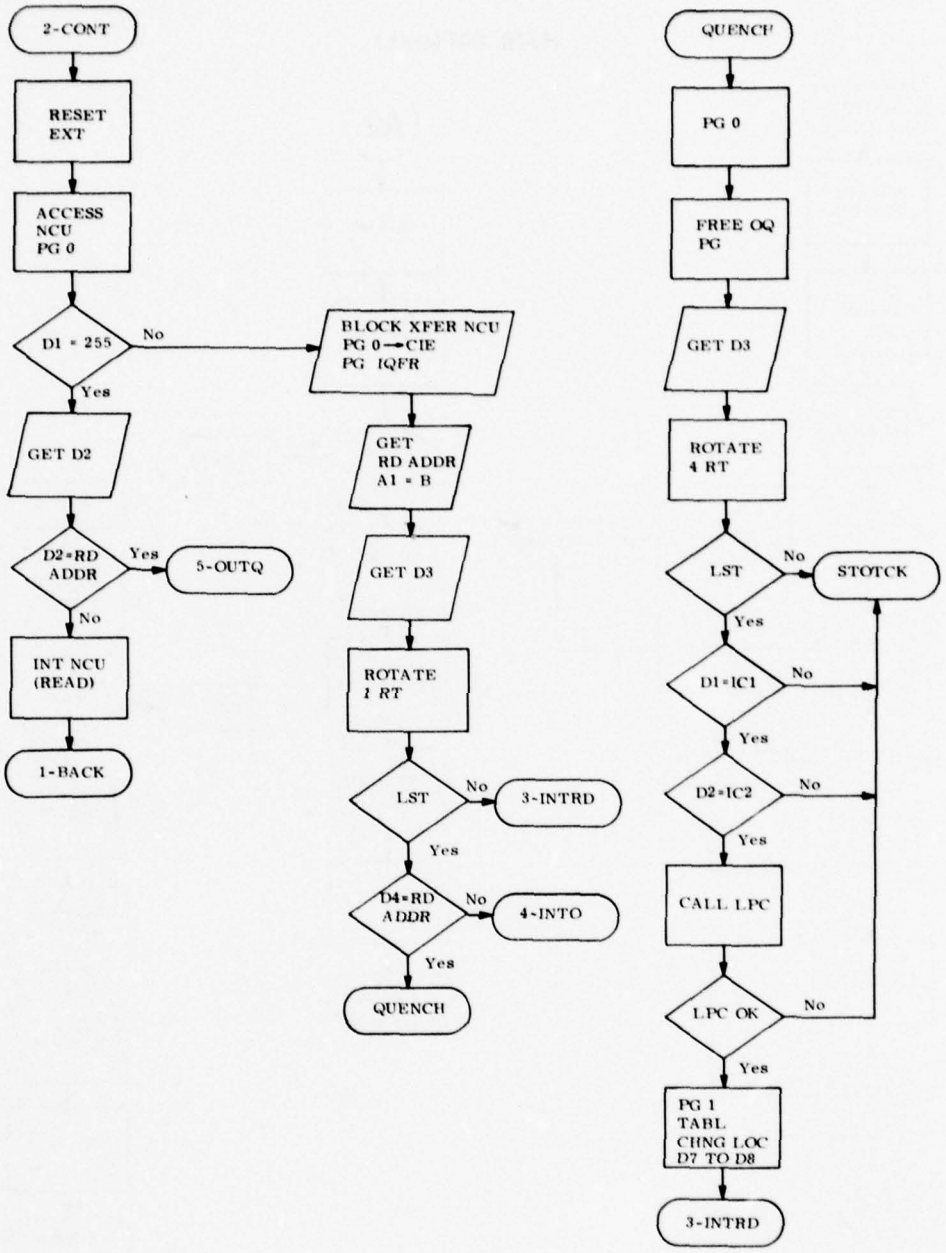


Figure 2-5. (Cont.)

HST5. DAT (cont.)

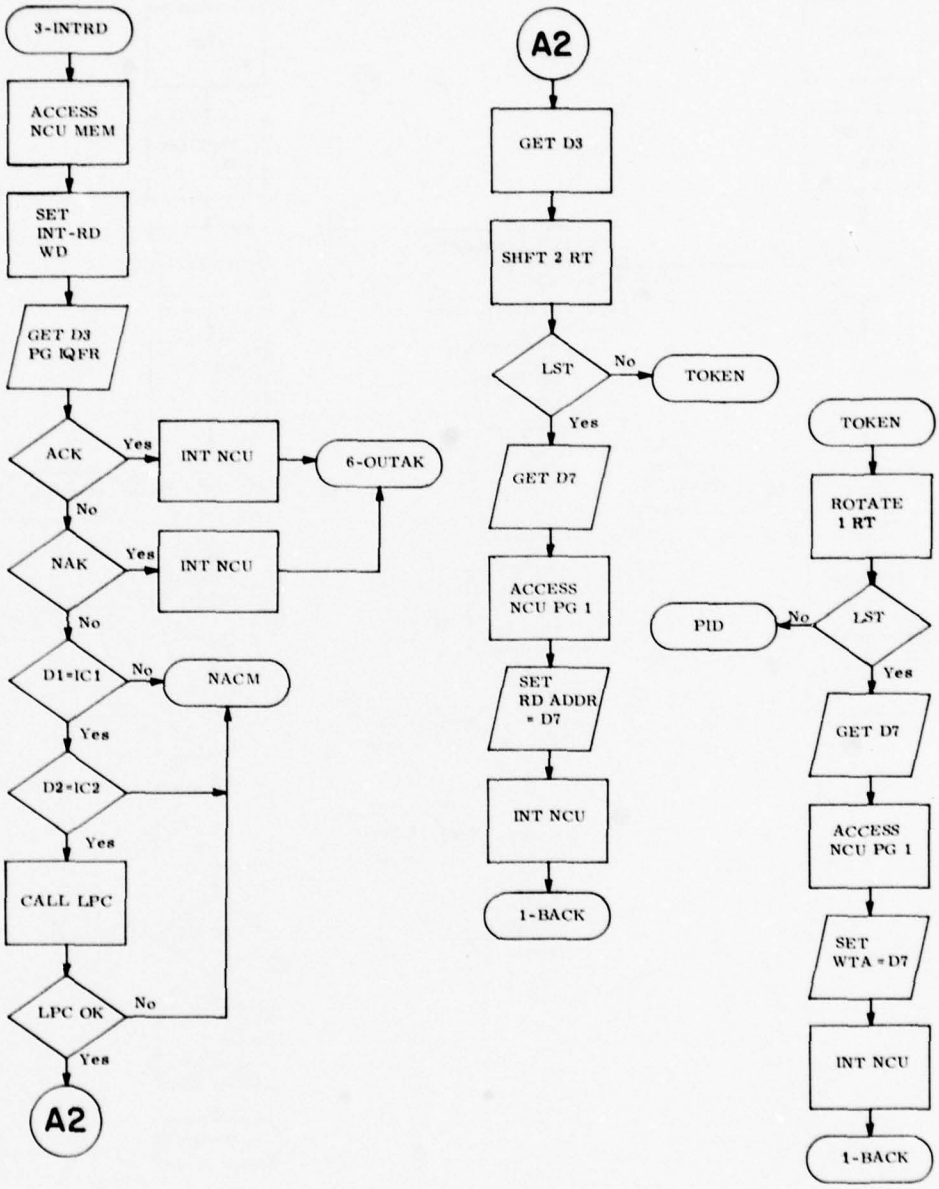


Figure 2-5. (Cont.)

HST5. DAT (cont.)

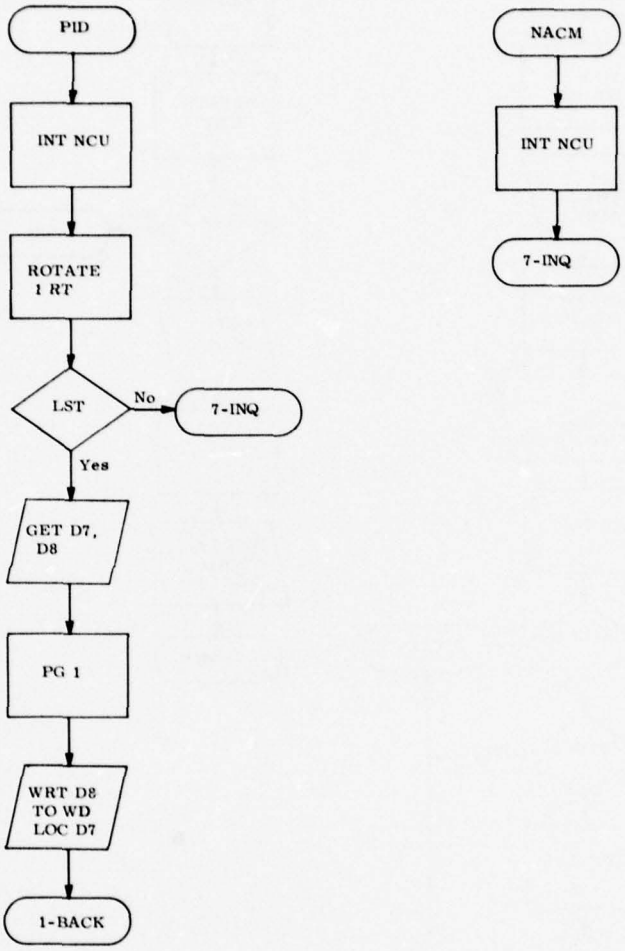


Figure 2-5. (Cont.)

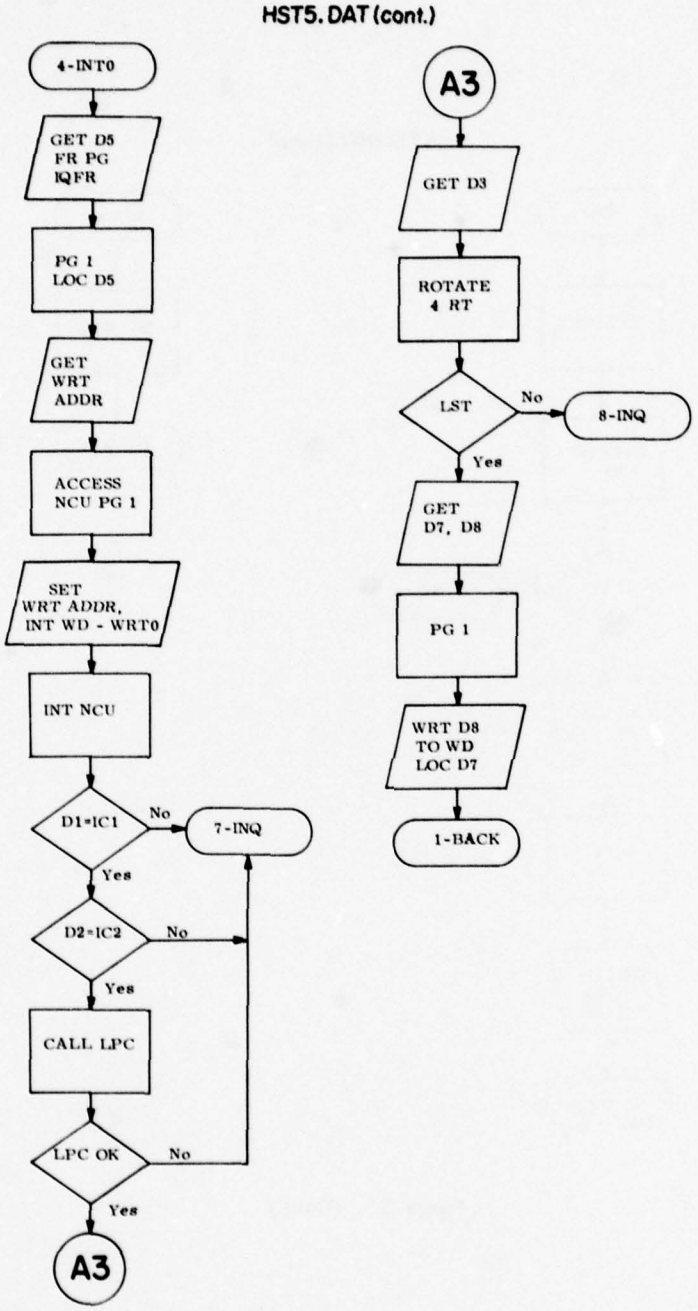


Figure 2-5. (Cont.)

HST5. DAT (cont.)

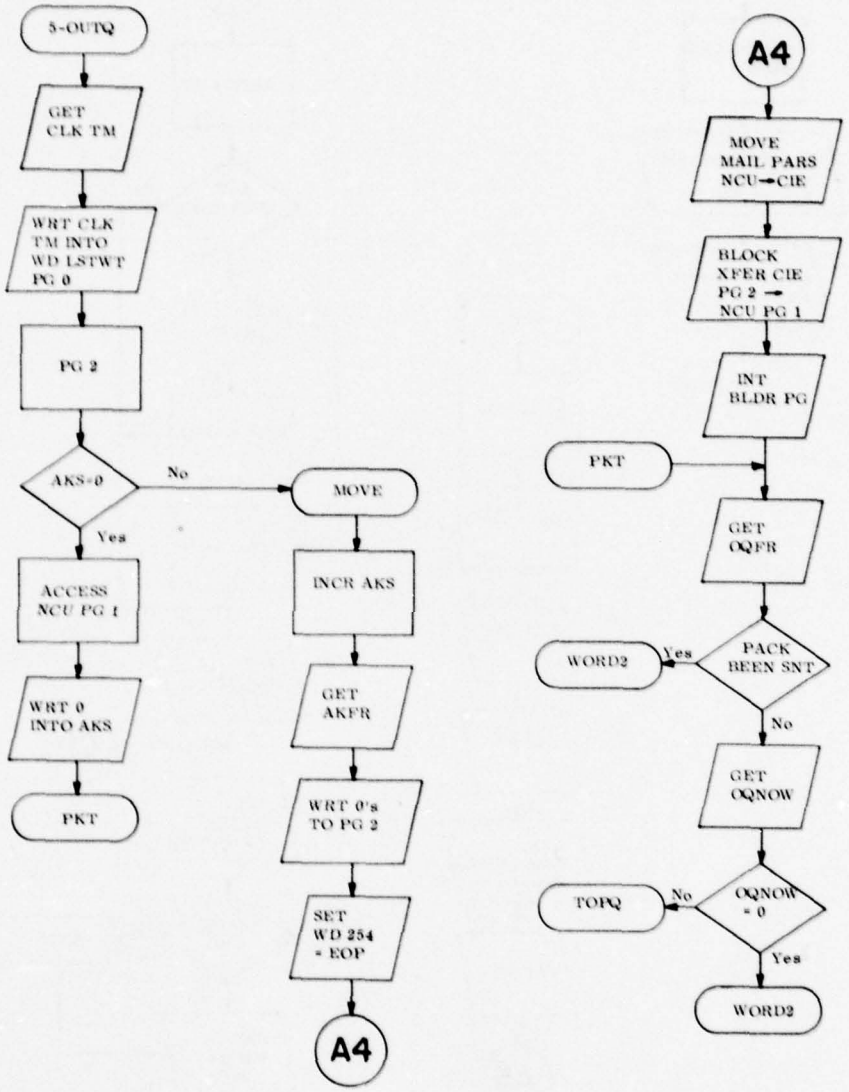


Figure 2-5. (Cont.)

HST5. DAT (cont.)

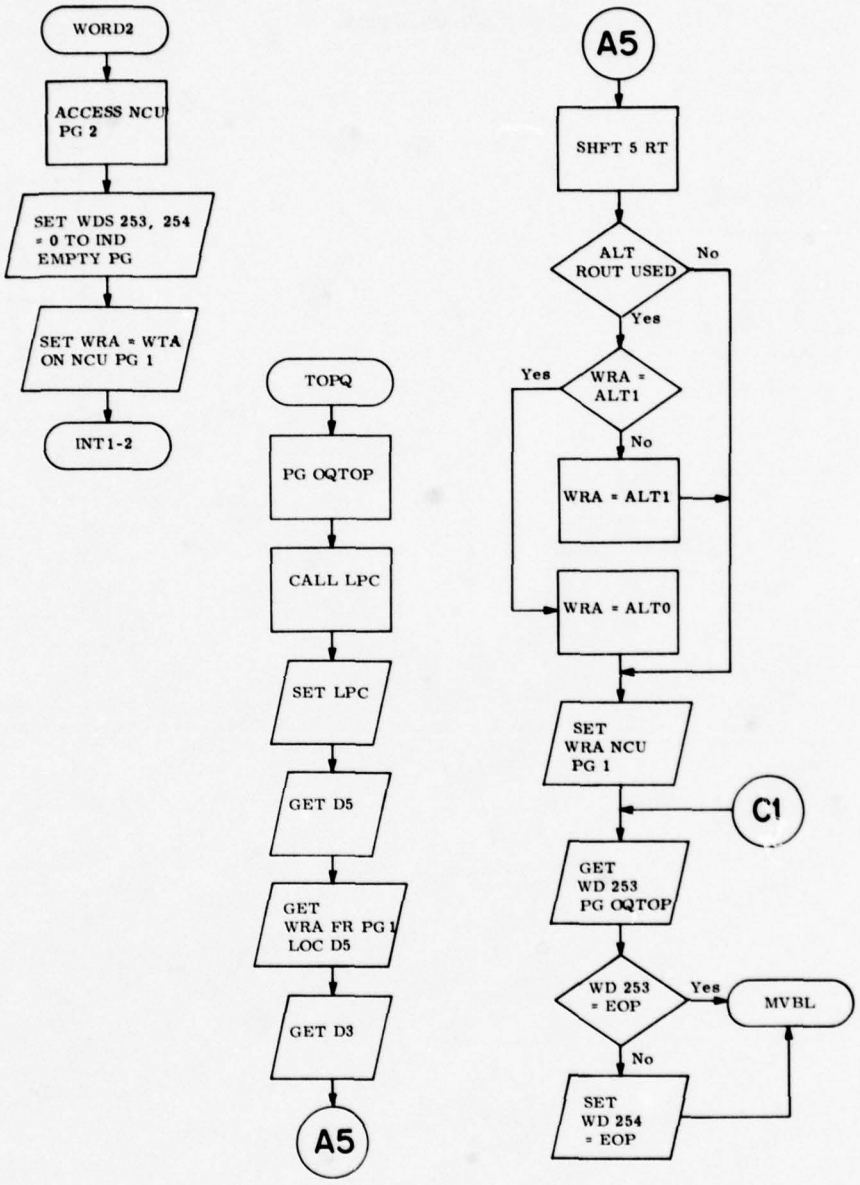


Figure 2-5. (Cont.)

HST5. DAT (cont.)

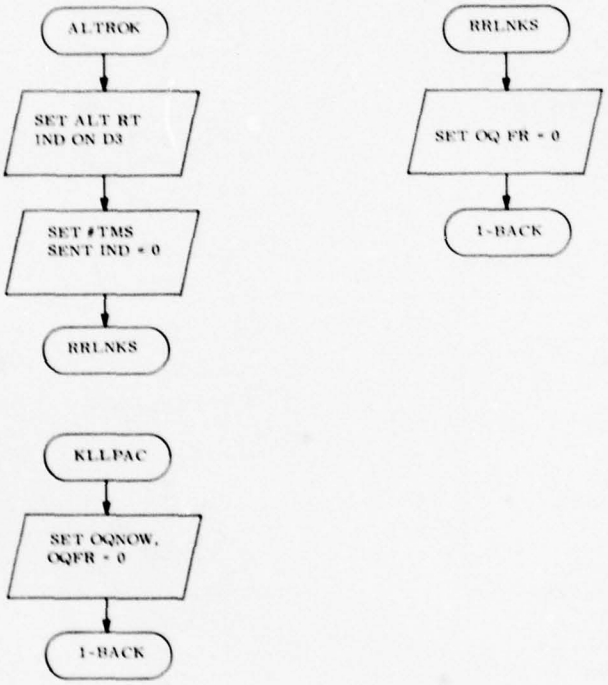


Figure 2-5. (Cont.)

HST5. DAT (cont.)

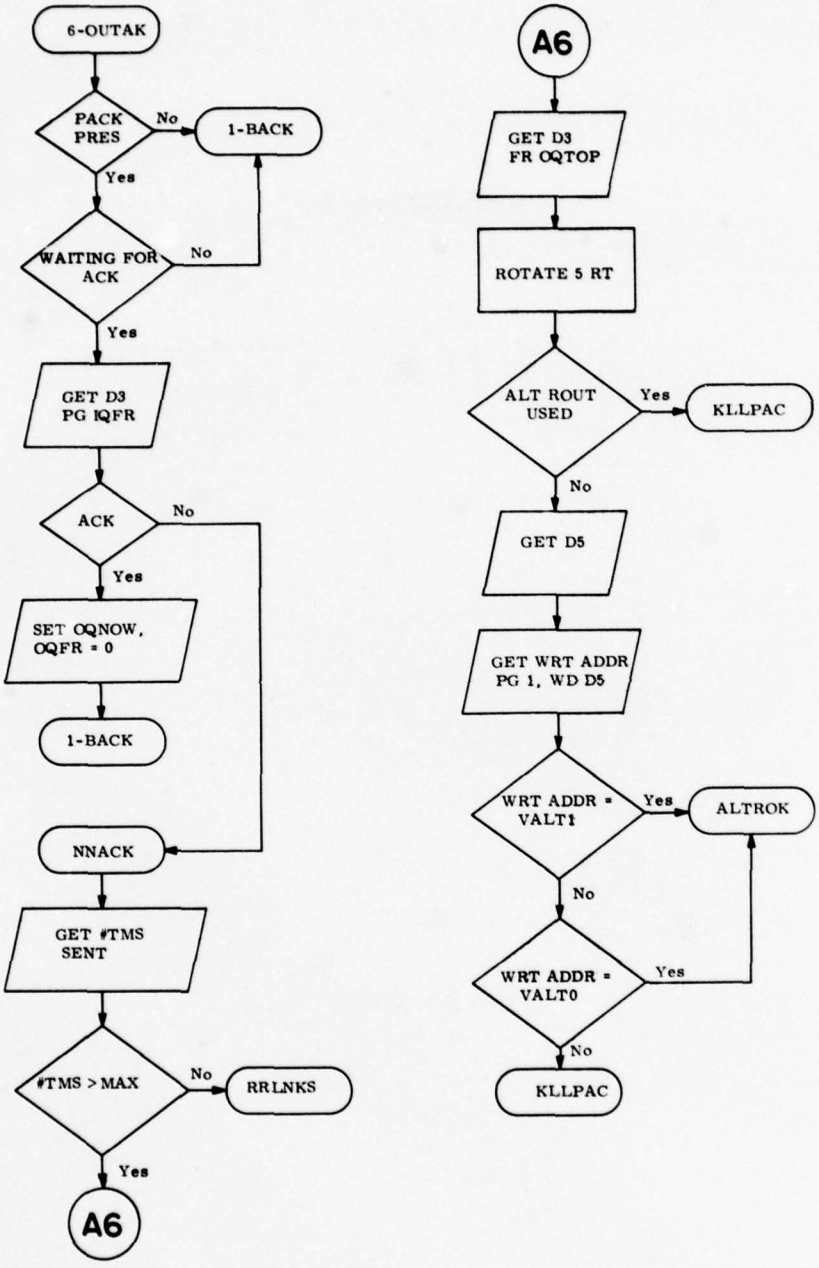


Figure 2-5. (Cont.)

HST5. DAT (cont.)

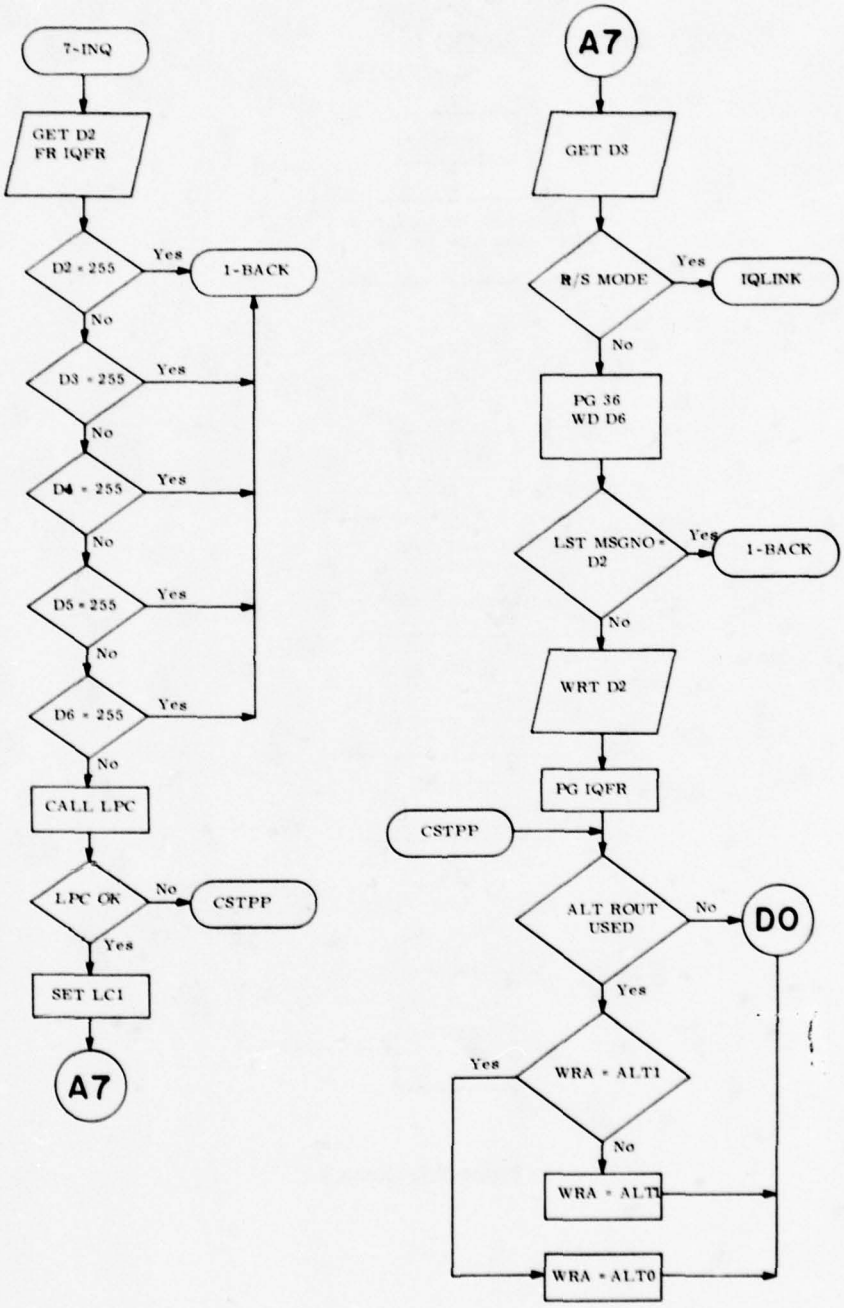


Figure 2-5. (Cont.)

HST5. DAT (cont.)

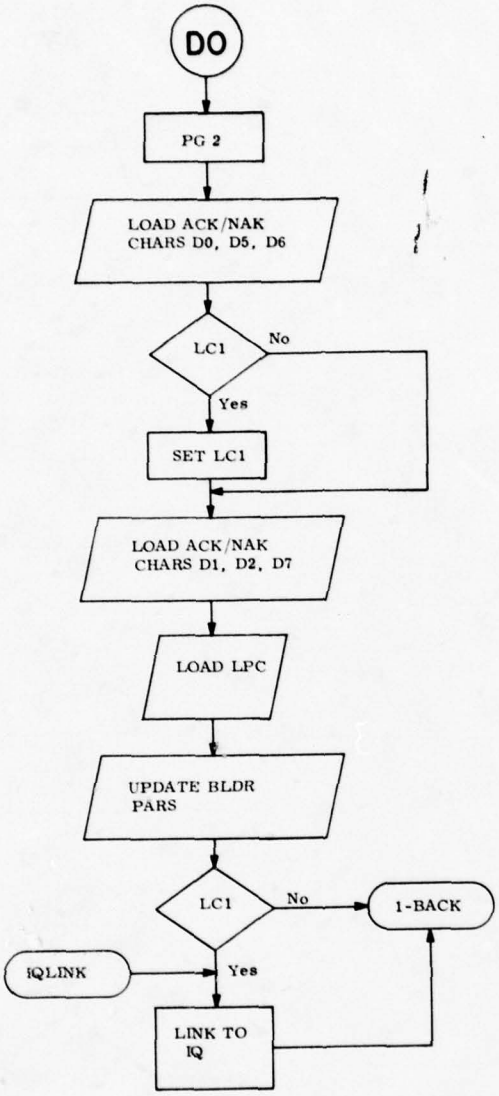


Figure 2-5. (Cont.)

HST5. DAT (cont.)

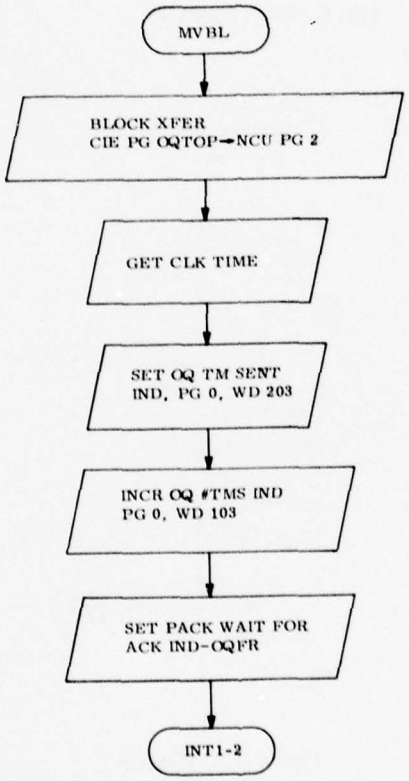


Figure 2-5. (Cont.)

HST5. DAT (cont.)

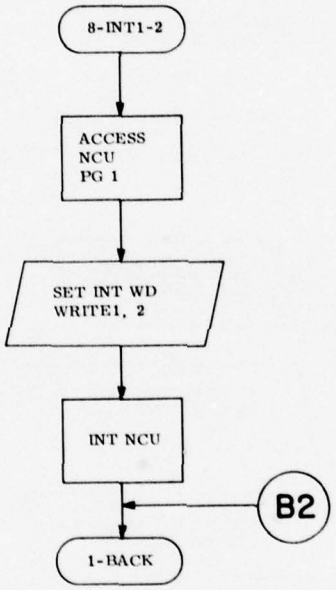


Figure 2-5. (Cont.)

HST5. DAT (cont.)

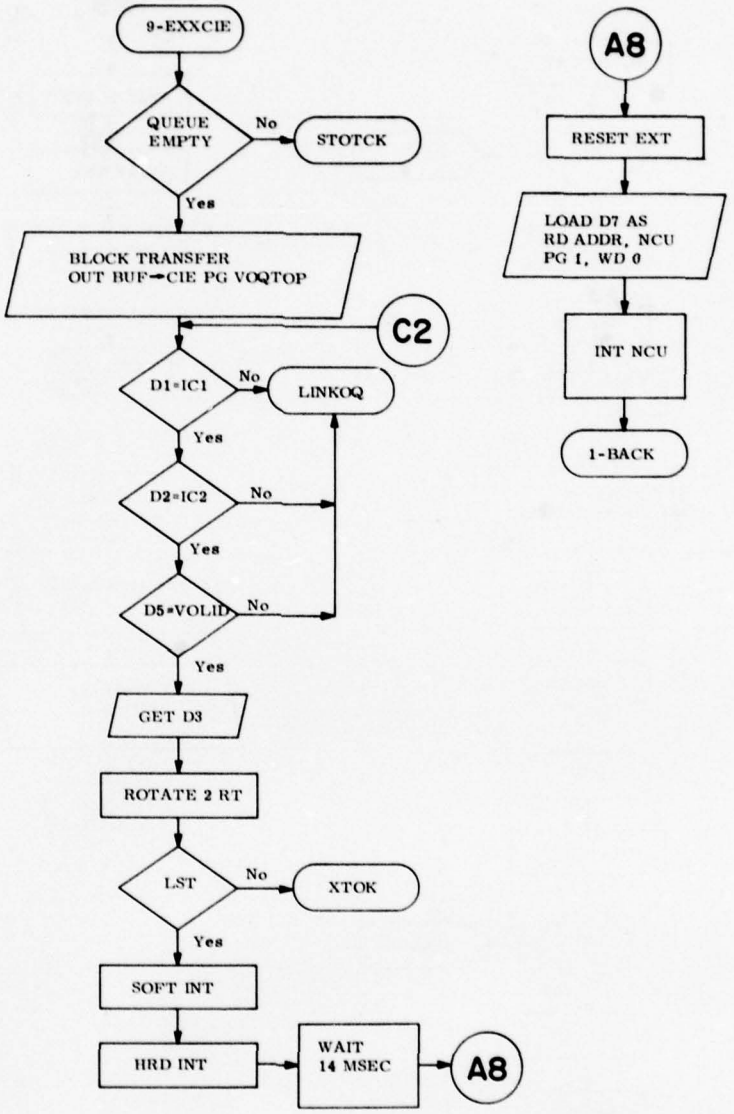


Figure 2-5. (Cont.)

HST5. DAT (cont.)

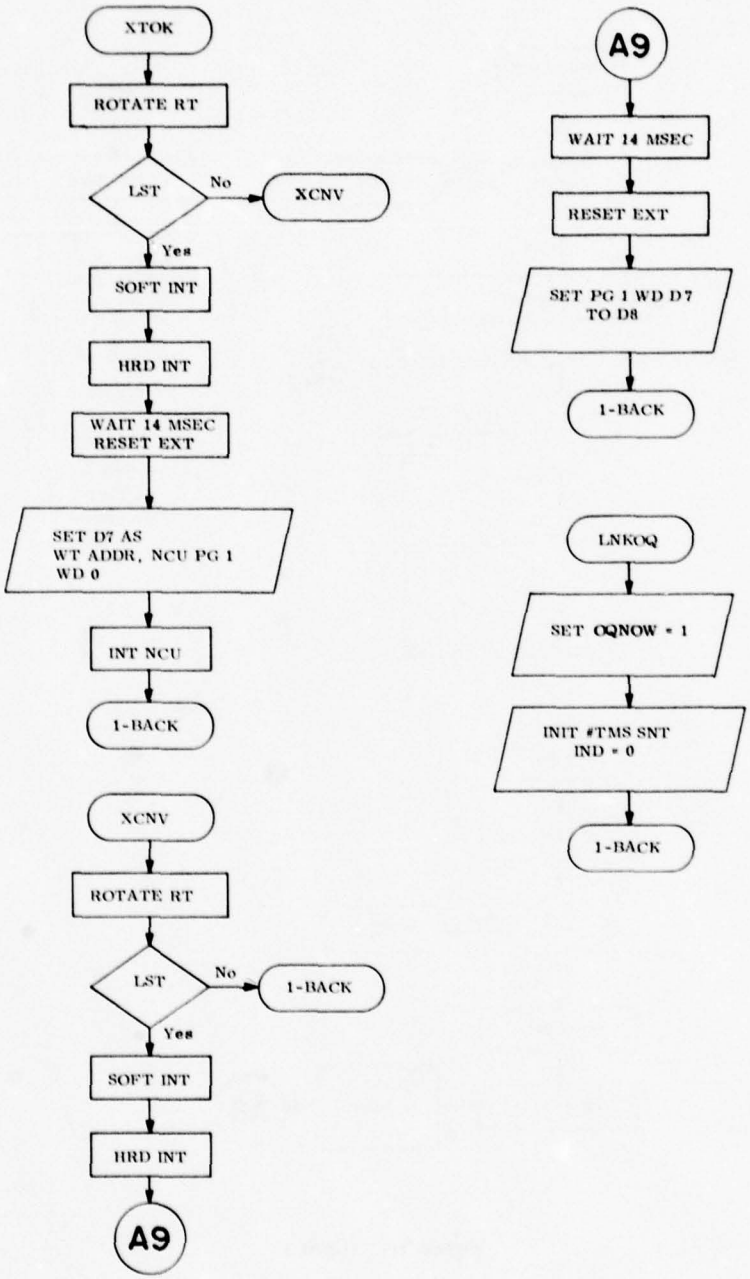


Figure 2-5. (Cont.)

HST5. DAT (cont.)

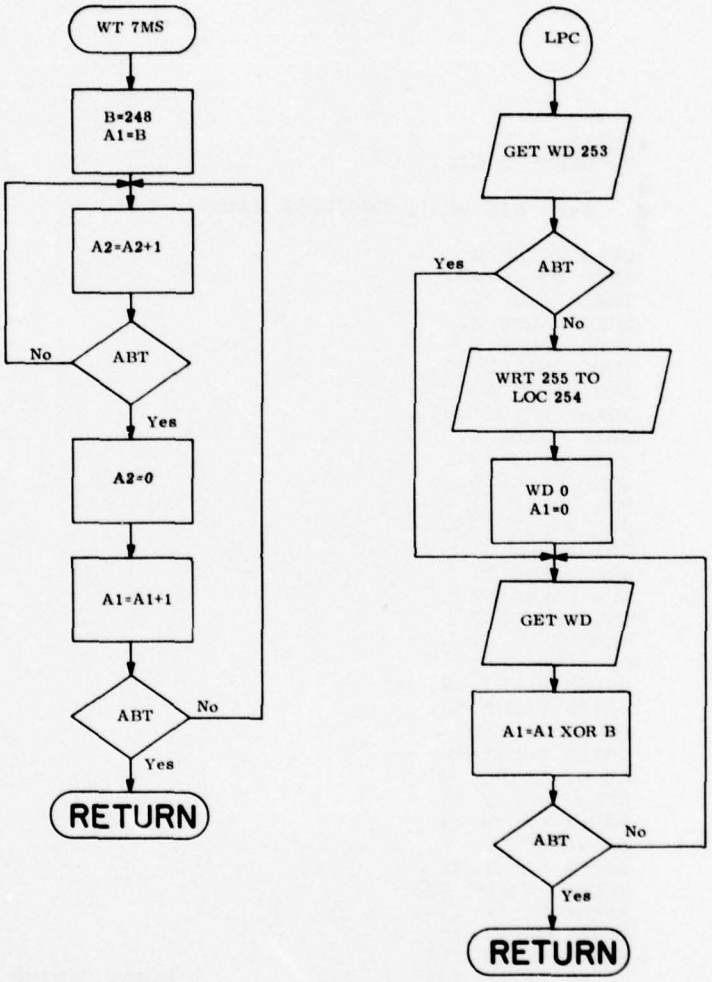


Figure 2-5. (Cont.)

```
 RUN [20,20]MDMPL
PLEASE ENTER INPUT SOURCE FILE NAME
HST5.DAT
PLEASE ENTER OUTPUT OBJECT FILE NAME
HST5.OBJ
WAIT FOR FIRST PASS - SCAN FOR LABELS .
  250 RECORDS READ
  500 RECORDS READ
  750 RECORDS READ
 1000 RECORDS READ
 1250 RECORDS READ
 1500 RECORDS READ
MPAD     CODE
```

```
                        $12BIT
                         PROGRAM-ID CIE.
                        *
                        *   **** CIE NODAL SOFTWARE ****
                        *
                         WKPG VALUE 0.
                         IQFR VALUE 47.
                         TABL VALUE 1.
                         AKFR VALUE 4.
                         BLDR VALUE 2.
                         IQNOW VALUE 45.
                         AKS VALUE 5.
                         IQMAX VALUE 44.
                         MAIL VALUE 1.
                         ICIE VALUE 4.
                         ZERO VALUE 0.
                         ONE VALUE 1.
                         EOP VALUE 255.
                         RDA VALUE 0.
                         WRA VALUE 1.
                         WTA VALUE 2.
                         INCU VALUE 3.
                         AKS VALUE 5.
                         ALT1 VALUE 1.
                         OQNOW VALUE 49.
                         OQTOP VALUE 50.
                         OQFR VALUE 51.
                         IQTOP VALUE 46.
                         LSTWT VALUE 53.
                         DFFWT VALUE 54.
                         OQMAX VALUE 48.
                         D3 VALUE 2.
                         AKCUR VALUE 3.
                         LOOPNO VALUE 253.
                         SYSNO VALUE 254.
                         OLID VALUE 149.
                         MSGNO VALUE 152.
                         COUNT VALUE 180.                    BLAST TIMING PARAMETER
                         VLOOPNO VALUE 4.
                         VSYSNO VALUE 11.
                         VAKCUR VALUE 6.
                         VRDA VALUE 2.
                         VWRA VALUE 1.
                         VWTA VALUE 1.
                         VINCU VALUE 0.
                         VAKS VALUE 0.
```

```
                    VAKFR VALUE 6.
                    VALT1 VALUE 1.
                    VALTO VALUE 3.
                    VIQMAX VALUE 10.
                    VIQNOW VALUE 0.
                    VIQTOP VALUE 3.
                    VIQFR VALUE 3.
                    VOQMAX VALUE 1.
                    VOQNOW VALUE 0.
                    VOQTOP VALUE 13.
                    VOQFR VALUE 0.
                    VDFFWT VALUE 7.                 #TICKS
                    VMAXTR VALUE 3.
                    VMAXCK VALUE 41.                #TICKS
                    VICIE VALUE 128.
                    VOLID VALUE 5.
                    VPDDLID VALUE 1.
                    VADDLID VALUE 11.
                    IC1 VALUE 85.          FOR CONT PACK
                    IC2 VALUE 170.
 0        3
 1     2216                 GOTO INIT.
                    *              DEBUG JUMPS
 2       23
 3     1736                 GOTO BACK.              HDWR ERR ROUT
 4       23
 5     7256                 GOTO CONT.
 6       43
 7     4756                 GOTO INTRD.
10       63
11     1736                 GOTO INTO.
12       63
13     5276                 GOTO OUTQ.
14      103
15     7216                 GOTO OUTAK.
16      123
17     3776                 GOTO INQ.
20      143
21     6056                 GOTO INT1-2.
22      143
23     6456                 GOTO EXXCIE.
                    *              7 MSEC WAIT SUB.
                    WT7MS.
24     7613                 B=248.
25      105                 A1=B.
26     1511                 A2=0.
                    INLP1.
27     4211                 A2=A2+1.
30     3707                 IF ABT SKIP ELSE STEP.
31        3
32      576                 GOTO INLP1.
33     1511                 A2=0.
34     2205                 A1=A1+1.
35     3707                 IF ABT SKIP ELSE STEP.
36        3
37      576                 GOTO INLP1.
40      657                 JUMP.
                    *
                    *
                    *        SUBROUTINE TO PUT LPC IN A1
```

```
                    LPC.
41        4                 DEV1=0.
                    *              ELIMINATE HANGS
42     7733                 B=253.
43      121                 OUT0=B.
44     2305                 A1=A1.
45     2345                 BEX1 A1=A1.
46      101                  B=B.
47     3627                 IF ABT STEP ELSE SKIP.
50        3
51     1376                 GOTO LPCINIT.
52     7753                 B=254.
53      121                 OUT0=B.
54     7773                 B=255.
55      131                 OUT2=B.
56      607                 STEP.
                    LPCINIT.
57     1521                 OUT0=0.
60     1505                 A1=0.
                    LPCILP.
61     2305                 A1=A1.                    GET WD
62     2345                 BEX1 A1=A1.
63     2505                 A1=A1 XOR B.              XOR
64      101                 B=B.                      SET COND F/FS
65     3707                 IF ABT SKIP ELSE STEP.    STOP IF EOP
66        3
67     1436                 GOTO LPCILP.
70      657                 JUMP.
                    *
                    *
                    *        PAGE SET, WORD SET,
                    *        READ, WRITE MEMORY SUBROUTINES
                    PG.                               PAGE SET SUB
71      125                 OUT1=B.                   PAGE IN B REG
72      657                 JUMP.                     RETURN
                    WD.                               WORD SET SUB
73      121                 OUT0=B.                   WORD LOC IN B
74      657                 JUMP.                     RETURN
                    RD.                               READ FR MEM SUB
75     2305                 A1=A1.                    PROVIDE 10 CLOCKS
76     2345                 BEX1 A1=A1.               RD INTO B REG
77      657                 JUMP.                     RETURN
                    WR.                               WRITE FR MEM SUB
100     131                 OUT2=B.                   FROM B
101     657                 JUMP.                     RETURN
                    *
                    *        BLAST TRANSFER SUBROUTINE
                    BLAST.
102    5513                 B=COUNT.                  SET CTR
                    AGAIN.
103       1                 B=B + 1.
104    3707                 IF ABT SKIP ELSE STEP.    TEST CTR
105       3
106    2076                 GOTO AGAIN.                  NO
107     657                 JUMP.                     YES, RETURN
                    *
                    INIT.
110     335                 OUT3 AMPCR=AMPCR.
111     335                 OUT3 AMPCR=AMPCR.       ACCESS NCU MEM
112       3
113     506                 CALL WT7MS.             GIVE NCU TM
```

```
114        3
115      506                  CALL WT7MS.
                     *              FAKE BLAST HST-CIE
116        4                  DEV1=0.
117     4351                  BEX2 A2=A2.
120      753                  B=30.
121      125                  OUT1=B.
122     1521                   OUT0=0.
123      607                  STEP.
124       44                    DEV1=2.
125        3
126     2046                  CALL BLAST.
127       24                  DEV1=1.
130      607                  STEP.
131     4351                  BEX2 A2=A2.
132        4                  DEV1=0.
133     1521                  OUT0=0.
134      607                    STEP.
135     3004                  DEV1=96.
136       33                  B=MAIL.
137        3
140     1626                  CALL PG.
141       13                  B=RDA.
142        3
143     1666                  CALL WD.
144       53                  B=VRDA.
145        3
146     2006                  CALL WR.
147       33                  B=VWRA.
150        3
151     2006                  CALL WR.
152       33                  B=VWTA.
153        3
154     2006                  CALL WR.
155       13                  B=VINCU.
156        3
157     2006                  CALL WR.
160     4013                  B=VICIE.
161        3
162     2006                  CALL WR.
163       13                  B=VAKS.
164        3
165     2006                  CALL WR.
166     7773                  B=255.
167      121                  OUT0=B.
170      131                  OUT2=B.
171     1525                  OUT1=0.
172      121                   OUT0=B.
173      131                  OUT2=B.
174     1521                  OUT0=0.
                     *          LOAD WORKPAGE
175        4                  DEV1=0.                  CIE MEM
176       13                  B=WKPG.
177        3
200     1626                  CALL PG.
201       33                  B=ALT1.
202        3
203     1666                  CALL WD.
204       33                  B=VALT1.
205        3
206     2006                  CALL WR.
```

```
207     73                  B=VALTO.
210      3
211   2006                  CALL WR.
212   7773                  B=255.                    LOC 2-43
213    105                  A1=B.                     =0
214   1253                  B=42.
215   2605                  A1=A1 - B.
                    *        A1=COUNTER
                     INRP1.
216     13                  B=ZERO.
217      3
220   2006                  CALL WR.
221   2205                  A1=A1 + 1.
222   3707                  IF ABT SKIP ELSE STEP.
223      3
224   4356                  GOTO INRP1.
225   1313                  B=IQMAX.
226    121                  OUTO=B.
227    253                  B=VIQMAX.
230      3
231   2006                  CALL WR.
232     13                  B=VIQNOW.
233      3
234   2006                  CALL WR.
235     73                  B=VIQTOP.
236      3
237   2006                  CALL WR.
240     73                  B=VIQFR.
241      3
242   2006                  CALL WR.
243     33                  B=VOQMAX.
244      3
245   2006                  CALL WR.
246     13                  B=VOQNOW.
247      3
250   2006                  CALL WR.
251    333                  B=VOQTOP.
252      3
253   2006                  CALL WR.
254     13                  B=VOQFR.
255      3
256   2006                  CALL WR.
257     53                  B=2.
260   2605                  A1=A1-B.
                     INRP2.
261     13                 B=ZERO.
262      3
263   2006                  CALL WR.
264   2205                  A1=A1+1.
265   3707                  IF ABT SKIP ELSE STEP.
266      3
267   5436                  GOTO INRP2.
270   1553                  B=DFFWT.
271    121                  OUTO=B.
272    173                  B=VDFFWT.                  LOC 54
273      3
274   2006                  CALL WR.
275   2713                  B=92.                     LOC 55-146
276   2605                  A1=A1 - B.                =0
                     INRP3.
```

```
277      13                    B=ZERO.
300       3
301    2006                    CALL WR.
302    2205                    A1=A1 + 1.
303    3707                    IF ABT SKIP ELSE STEP.
304       3
305    5776                    GOTO INRP3.
                     *          CRT NODE USES LOCS. 149,150,151 OLID,PDDLID,
306    4533                    B=OLID.                          ADDLID
307       3
310    1666                    CALL WD.
311     133                    B=VOLID.
312       3
313    2006                    CALL WR.
314      33                    B=VPDDLID.
315       3
316    2006                    CALL WR.
317     273                    B=VADDLID.
320       3
321    2006                    CALL WR.
322    3013                    B=96.                      LOC 152-247
323    2605                    A1=A1 - B.                 =0
                   INRP4.
324      13                    B=ZERO.
325       3
326    2006                    CALL WR.
327    2205                    A1=A1 + 1.
330    3707                    IF ABT SKIP ELSE STEP.
331       3
332    6516                    GOTO INRP4.
333    7733                    B=LOOPNO.
334       3
335    1666                    CALL WD.
336     113                    B=VLOOPNO.
337       3
340    2006                    CALL WR.
341     273                    B=VSYSNO.
342       3
343    2006                    CALL WR.
                     *          LOAD CONVERSION PG
                     *          SPECIAL LIDS MAY ALSO
                     *          BE LOADED AT A LATER TIME
344      33                    B=TABL.
345       3
346    1626                    CALL PG.
347      13                    B=ZERO.
350       3
351    1666                    CALL WD.
352     105                    A1=B.
353      13                    B=ZERO.                SND TO FAD 0
                   INRP5.
354       3
355    2006                    CALL WR.
356    2205                    A1=A1 + 1.
357    3707                    IF ABT SKIP ELSE STEP.
360       3
361    7316                    GOTO INRP5.
362      33                    B=ONE.
363       3
364    1666                    CALL WD.
```

```
365       3
366    2006                    CALL WR.
367       3
370    2006                    CALL WR.
371       3
372    2006                    CALL WR.
373     113                     B=4.
374       3
375    2006                    CALL WR.
376      53                    B=2.
377       3
400    2006                    CALL WR.
401      33                    B=ONE.
402       3
403    2006                    CALL WR.
404      73                    B=3.
405       3
406    2006                    CALL WR.
407       3
410    2006                    CALL WR.
411       3
412    2006                    CALL WR.
413       3
414    2006                    CALL WR.
415       3
416    2006                    CALL WR.
417    3773                     B=127.                          CRT BRDCST
420       3
421    1666                    CALL WD.
422      33                    B=VWTA.
423       3
424    2006                    CALL WR.
425    7653                    B=250.                  HST-HST
426       3
427    1666                    CALL WD.
430      33                    B=ONE.
431       3
432    2006                    CALL WR.
433    7753                    B=254.                  SYST BROAD
434       3
435    1666                    CALL WD.
436      33                    B=VWTA.
437       3
440    2006                    CALL WR.
                       *         LOAD ACK/NAK BUILDER PG
441      53                    B=BLDR.
442       3
443    1626                    CALL PG.
444      73                    B=3.
445       3
446    1666                    CALL WD.
447     153                    B=VAKCUR.
450       3
451    2006                    CALL WR.
452     153                    B=VAKFR.
453       3
454    2006                    CALL WR.
455      13                    B=VAKS.
456       3
457    2006                    CALL WR.
```

```
                        *               LOAD PG 36-DUPL MSGNO PG
                        *               HOLDS LAST SEQ # FOR EACH LID
  460      1113                 B=36.
  461         3
  462      1626                 CALL PG.
  463        13                 B=ZERO.
  464         3
  465      1666                 CALL WD.
                        INRP6.
  466         3
  467      2006                 CALL WR.
  470         1                 B=B+1.
  471      3707                 IF ABT SKIP ELSE STEP.
  472        23
  473      1556                 GOTO INRP6.
                        *        DATA MEM IS NOW INITIALIZED
                        *        SET NCU EXT TO FORCE IT
                        *        TO THE READ STATE
  474        20                 DEVO=1.                    INT NCU
                        *
                        *        *** #1 BACKGROUND MODULE ***
                        *
                        BACK.
  475       607                 STEP.
  476       607                 STEP.
  477         4                 DEV1=0.                    CLEAR
  500        13                 B=WKPG.                    WORKPAGE
  501         3
  502      1626                 CALL PG.
  503      7627                 IF EXT STEP ELSE SKIP.     INT PRES:
  504        23
  505      7256                 GOTO CONT.                EXIT #2
  506        13                 B=ZERO.
  507       141                 BEXO B=B.                  GET STATUS BUF REG
  510       101                 B=B.                       SET COND F/FS
  511      2627                 IF LST STEP ELSE SKIP.     OUT BUF FULL?
  512       143
  513      6456                 GOTO EXXCIE.                YES
  514       101                 B=B.
  515       707                 IF MST SKIP ELSE STEP.     IN BUF EMPTY?
  516        23
  517      4736                 GOTO WTTM.                 NO
  520      1333                 B=IQNOW.                   YES
  521         3
  522      1666                 CALL WD.                   GET CURRENT
  523         3
  524      1726                 CALL RD.                   IQ SIZE
  525       401                 B=0 EQV B.                 =0?
  526      3627                 IF ABT STEP ELSE SKIP.
  527        23
  530      4736                 GOTO WTTM.                 YES
                        *        NO-BLAST TRANSFER CONTENTS ON
                        *        PG IQTOP TO INPUT BUFFER
  531      1353                 B=IQTOP.                   GET IQTOP VALUE
  532         3
  533      1666                 CALL WD.
  534         3
  535      1726                 CALL RD.
  536       105                 A1=R.                      SAVE A1=IQTOP
  537         4                 DEV1=0.
```

```
540      30                  DEV2=1.
541     607                  STEP.
542       3
543    1626                  CALL PG.                  PG IQTOP
544      13                  B=ZERO.
545       3
546    1666                  CALL WD.
547     104                  DEV1=4.                   BLAST CIE-EXO
550       3
551    2046                  CALL BLAST.
552      24                  DEV1=1.                   TERMINATE BLAST
553     607                  STEP.
554      30                  DEV2=1.                 SND STATUS
555     607                  STEP.
556       4                  DEV1=0.                   CLEAR
557    1521                  OUT0=0.
560     607                  STEP.
561      13                  B=WKPG.                   WORKPAGE
562       3
563    1626                  CALL PG.
564       3
565     506                    CALL WT7MS.
566    1333                  B=IQNOW.                  GET IQNOW
567       3
570    1666                  CALL WD.
571       3
572    1726                  CALL RD.
573     105                  A1=B.                   DECR IQNOW
574      33                  B=ONE.
575    2205                  A1=A1+1.
576    2705                  A1=A1-B-1.
577    1333                  B=IQNOW.
600       3
601    1666                  CALL WD.
602    2301                  B=A1.
603       3
604    2006                  CALL WR.
605    1353                  B=IQTOP.                  GET IQTOP
606       3
607    1666                  CALL WD.
610       3
611    1726                  CALL RD.
612       1                  B=B + 1.                  INCR IQTOP
613     105                  A1=B.                     A1=NEW IQTOP
614     253                  B=VIQMAX.                  GET IQMAX
615     111                  A2=B.                     A2=IQMAX
616      73                  B=3.
617    4101                  B=A2 + B.                 B=IQMAX+ 3
620    2415                  A3=A1 EQV B.              IQTOP=B?
621    3707                  IF ABT SKIP ELSE STEP.
622      23
623    4556                  GOTO WRIQT.               NO
624      73                  B=3.                      YES, WRAPAROUND
625     105                  A1=B.
                    WRIQT.
626    1353                  B=IQTOP.                  WRITE IQTOP
627       3
630    1666                  CALL WD.
631    2301                  B=A1.
632       3
```

```
633     2006                    CALL WR.
634        4                    DEV1=0.                    ENABLE MAR INCR
                        *        LOOK FOR TIMEOUTS TO
                        *        GENERATE NEW WTS
                         WTTM.
635     7627                    IF EXT STEP ELSE SKIP.    INT PRES!
636       23
637     7256                    GOTO CONT.                EXIT
640       13                    R=ZERO.
641      141                    REXO R=R.                  GET STATUS BUF REG
642      101                    R=R.                       SET COND F/FS
643     2627                    IF LST STEP ELSE SKIP.    OUT BUF FULL?
644      143
645     6456                    GOTO EXXCIE.               YES
                         STOTCK.
646        4                    DEV1=0.
647       13                    R=WKPG.
650        3
651     1626                    CALL PG.
652     6355                    REX3 A3=A3.                GET CLK TM
653      105                    A1=R.                      A1=CURCLK TIME
654     1533                    R=LSTWT.                   GET LAST WT
655        3
656     1666                    CALL WD.                   RECEPT TM
657        3
660     1726                    CALL RD.
661     2705                    A1=A1-R-1.                A1=DFF
662      173                    R=VDFFWT.                    GET MAX
663     2205                    A1=A1+1.
664     2205                    A1=A1+1.
665     2705                    A1=A1-R-1.                A1>MAXDEF?
666     1707                     IF AOV SKIP ELSE STEP.
667       23
670     6076                    GOTO PAKOUT.              ACK TMOUT RTN
671       20                    DEVO=1.                   SOFT INT
672       34                    DEV3=1.                          HRD INT NCU
673        3
674      506                    CALL WT7MS.               WAIT FOR SYNCH
675        3
676      506                    CALL WT7MS.
677      335                    OUT3 AMPCR=AMPCR.
700      335                    OUT3 AMPCR=AMPCR.
701       63
702     5276                    GOTO OUTQ.                 AS IF WT RECEIVED
                        *        LOOK AT OUTSTANDING
                        *        PACKET ON OUTPUT PAGE
                        *        WAITING FOR ACK
                         PAKOUT.
                        *                MSG SENT TIMEOUT WAIT ROUTINE
703        4                    DEV1=0.
704       13                    R=WKPG.
705        3
706     1626                    CALL PG.
707     1433                    R=OQNOW.
710        3
711     1666                    CALL WD.
712        3
713     1726                    CALL RD.
714      401                    R=0 EQV R.
715     3627                    IF ABT STEP ELSE SKIP. PACK PRES?
```

```
716      23
717    1736                    GOTO BACK.              NO
720    1473                    B=OQFR.
721       3
722    1666                    CALL WD.
723       3
724    1726                    CALL RD.
725     401                    B=0 EQV B.
726    3627                    IF ABT STEP ELSE SKIP. ACK WAITING?
727      23
730    1736                    GOTO BACK.              NO
731    6355                    BEX3 A3=A3.             YES,GET CLK TM
732     105                    A1=B.                   A1=CURCLK TM
733    6273                    B=203.                  GET TM SENT
734       3
735    1666                    CALL WD.
736       3
737    1726                    CALL RD.
740    2705                    A1=A1-B-1.              A1=DFF
741    1233                    B=VMAXCK.                       GET MAX
742    2205                    A1=A1+1.
743    2205                    A1=A1+1.
744    2705                    A1=A1-B-1.
745    1707                    IF AOV SKIP ELSE STEP. A1>MAXDFF?
746      23
747    1736                    GOTO BACK.
750     123
751    1056                    GOTO NNACK.             YES,NAK REC
                    *
                    *
                    *        *** #2 NODE CONTROLLER MODULE ***
                    *
                     CONT.
752     607                    STEP.
753     607                    STEP.
754     335                     OUT3 AMPCR=AMPCR.
755     335                    OUT3 AMPCR=AMPCR.                       RESET EXT
756    3004                    DEV1=96.
757      13                    B=ZERO.
760       3
761    1626                    CALL PG.
762       3
763    1666                    CALL WD.
764       3
765    1726                    CALL RD.                GET D1
766     101                    B=B.                    SET COND F/FS
767    3707                    IF ABT SKIP ELSE STEP.   D1=255?
770      43
771     516                    GOTO RS.                NO
772       3
773    1726                    CALL RD.                YES, WT
774     111                    A2=B.                   A2=D2
775    3004                    DEV1=96.                ACCESS NCU
776      33                    B=MAIL.                 MAILBOX PG
777       3
1000   1626                    CALL PG.
1001     13                    B=ZERO.                 WD 0
1002      3
1003   1666                    CALL WD.
1004      3
```

```
1005    1726                CALL RD.                    GET RD ADDR
1006     105                A1=B.                       A1=RD ADDR
1007    4401                B=A2 EQV B.                 D2=RD ADDR?
1010    3627                IF ABT STEP ELSE SKIP.
1011      63
1012    5276                GOTO OUTQ.                   YES, VALID WT
1013     113                B=ICIE.                     WD ICIE
1014       3
1015    1666                CALL WD.
1016    4013                B=128.                      SET MSB
1017       3
1020    2006                CALL WR.                    WRITE ICIE
1021      20                DEV0=1.                     INT NCU - (READ)
1022      23
1023    1736                GOTO BACK.                  RETURN TO BACK
                        RS.
1024       4                DEV1=0.
1025      13                B=WKPG.
1026       3
1027    1626                CALL PG.
1030    1373                 B=IQFR.
1031       3
1032    1666                CALL WD.
1033       3
1034    1726                 CALL RD.
1035     115                A3=B.
1036       3
1037    1626                CALL PG.
1040      13                B=ZERO.
1041       3
1042    1666                CALL WD.
1043    3004                DEV1=96.
1044       3
1045    1626                CALL PG.
1046       3
1047    1666                 CALL WD.
1050    2404                 DEV1=80.
1051       3
1052    2046                CALL BLAST.
1053      24                DEV1=1.
1054       4                DEV1=0.
1055    1521                OUT0=0.
1056     607                STEP.
1057    3004                DEV1=96.                    ACCESS NCU
1060      33                B=MAIL.                     MAILBOX PG
1061       3
1062    1626                CALL PG.
1063      13                B=ZERO.                     GET RD ADDR
1064       3
1065    1666                CALL WD.
1066       3
1067    1726                CALL RD.
1070     105                A1=B.                       A1=RD ADDR
1071       4                DEV1=0.                     RTN CIE MEM
1072    6301                B=A3.                       PG IQFR
1073       3
1074    1626                CALL PG.
1075      53                B=2.                        WD 2
1076       3
1077    1666                CALL WD.
```

```
1100      3
1101   1726                    CALL RD.                    GET D3
1102    161                    BS=B.                       ROTATE 1 RT
1103    101                    B=B.                        SET COND F/FS
1104   2707                    IF LST SKIP ELSE STEP.      R/S BIT ON?
1105     43
1106   4756                    GOTO INTRD.                 NO
1107     73                    B=3.                        YES
1110      3
1111   1666                    CALL WD.                    GET D4
1112      3
1113   1726                    CALL RD.
1114   2401                    B=A1 EQV B.                 D4=RD ADDR?
1115   3707                    IF ABT SKIP ELSE STEP.
                       *        IF YES, QUENCH BROADCAST
1116     63
1117   1736                    GOTO INTO.
                       *          ROUTINE QUENCH
                       *          USED TO QUENCH BROADCASTS
                        QUENCH.
1120     13                    B=WKPG.                                 FREE QQ
1121      3
1122   1626                    CALL PG.
1123   1433                    B=QQNOW.
1124      3
1125   1666                    CALL WD.
1126     13                    B=ZERO.
1127      3
1130   2006                    CALL WR.
1131   1473                    B=QQFR.
1132      3
1133   1666                    CALL WD.
1134     13                    B=ZERO.
1135      3
1136   2006                    CALL WR.
1137   6301                    B=A3.                       PG IQFR
1140      3
1141   1626                    CALL PG.
1142     53                    B=2.
1143      3
1144   1666                    CALL WD.
1145      3
1146   1726                     CALL RD.                               GET D3
1147    161                    BS=B.
1150    161                    BS=B.
1151    161                    BS=B.
1152    161                    BS=B.
1153    101                    B=B.
1154   2707                    IF LST SKIP ELSE STEP.
1155     23
1156   5156                    GOTO STOTCK.                EXIT
1157     13                      B=ZERO.
1160      3
1161   1666                    CALL WD.
1162      3
1163   1726                    CALL RD.
1164    115                    A3=B.
1165   2533                    B=IC1.
1166   6401                    B=A3 EQV B.
1167   3707                    IF ABT SKIP ELSE STEP.
```

```
1170      23
1171    5156                    GOTO STOTCK.
1172       3
1173    1726                    CALL RD.
1174     115                    A3=B.
1175    5253                    B=IC2.
1176    6401                    B=A3 EQV B.
1177    3707                    IF ABT SKIP ELSE STEP.
1200      23
1201    5156                    GOTO STOTCK.
1202       3
1203    1026                    CALL LPC.
1204    2305                    A1=A1.
1205    2345                    BEX1 A1=A1.
1206    2401                    B=A1 EQV B.
1207    3707                    IF ABT SKIP ELSE STEP.
1210      23
1211    5156                    GOTO STOTCK.
1212     153                     B=6.
1213       3
1214    1666                    CALL WD.                        GET D7
1215       3
1216    1726                    CALL RD.
1217     111                    A2=B.                   A2=LID TO CHNG
1220       3
1221    1726                    CALL RD.
1222     115                     A3=B.                  A3=NEW FAD
1223      33                    B=TABL.
1224       3
1225    1626                    CALL PG.
1226    4301                    B=A2.
1227       3
1230    1666                    CALL WD.
1231    6301                    B=A3.
1232       3
1233    2006                    CALL WR.
1234      23
1235    5156                    GOTO STOTCK.            EXIT
                        *
                        *        *** #3 NCU READ INT MODULE ***
                        *
                         INTRD.
1236     607                    STEP.
1237     607                    STEP.
1240    3004                    DEV1=96.                  ACCESS NCU
1241      33                    B=MAIL.                   MAILBOX PG
1242       3
1243    1626                    CALL PG.
1244     113                    B=ICIE.                   WD ICIE
1245       3
1246    1666                    CALL WD.
1247    4013                    B=128.                    SET MSB
1250       3
1251    2006                    CALL WR.                  WRITE INT-READ
1252       4                    DEV1=0.                   CLEAR
1253      13                    B=WKPG.                   WORKPAGE
1254       3
1255    1626                    CALL PG.
1256    1373                    B=IQFR.                   WD IQFR
1257       3
```

```
1260    1666                    CALL WD.
1261       3
1262    1726                    CALL RD.                GET IQFR
1263     105                    A1=B.                   A1=IQFR
1264       3
1265    1626                    CALL PG.                PG IQFR
1266      53                    B=2.                    WD 2
1267       3
1270    1666                    CALL WD.                GET D3
1271       3
1272    1726                    CALL RD.                B=D3
1273     101                    B=B.                    SET COND F/FS
1274    2707                    IF LST SKIP ELSE STEP.  ACK BIT ON?
1275      43
1276    6056                    GOTO CKFNK.             NO
                        *         YES, AN ACK RECEIVED
                         EXOT1.
1277      20                    DEVO=1.                 INT NCU
1300     103
1301    7216                    GOTO OUTAK.             YES
                         CKFNK.
1302     101                    B=B.
1303     707                    IF MST SKIP ELSE STEP.  NAK BIT ON?
                        *         NO
1304      43
1305    6236                    GOTO CNWMD.
                        *         YES, A NAK RECEIVED
                         EXOT2.
1306      20                    DEVO=1.                 INT NCU
1307     103
1310    7216                    GOTO OUTAK.             YES
                         CNWMD.
1311      13                    B=ZERO.
1312       3
1313    1666                    CALL WD.
1314       3
1315    1726                    CALL RD.
1316     115                    A3=B.
1317    2533                    B=IC1.
1320    6401                    B=A3 EQV B.
1321    3707                    IF ABT SKIP ELSE STEP.
1322      63
1323    1636                    GOTO NACM.
1324       3
1325    1726                    CALL RD.
1326     115                    A3=B.
1327    5253                    B=IC2.
1330    6401                    B=A3 EQV B.
1331    3707                    IF ABT SKIP ELSE STEP.
1332      63
1333    1636                    GOTO NACM.
1334       3
1335    1026                    CALL LPC.                       CK LPC
1336    2305                    A1=A1.
1337    2345                    BEX1 A1=A1.
1340    2401                    B=A1 EQV B.
1341    3707                    IF ABT SKIP ELSE STEP.
1342      63
1343    1636                    GOTO NACM.
1344      53                    B=2.
```

```
1345      3
1346   1666                    CALL WD.
1347      3
1350   1726                    CALL RD.
1351    161                    BS=B.                    SHIFT 2 RT
1352    161                    BS=B.
1353    101                    B=B.                     SET COND F/FS
1354   2707                    IF LST SKIP ELSE STEP.   RD ADDR ON?
1355     63
1356     76                    GOTO TOKEN.              NO
                        *     MODIFY READ ADDRESS -FAD-
1357    153                    B=6.                     WD 6
1360      3
1361   1666                    CALL WD.
1362      3
1363   1726                    CALL RD.                 GET D7
1364    111                    A2=B.                     A2=D7
1365   3004                    DEV1=96.                 ACCESS NCU
1366     33                    B=MAIL.                  MAILBOX PG
1367      3
1370   1626                    CALL PG.
1371     13                    B=ZERO.
1372      3
1373   1666                    CALL WD.                 RD ADDR WD
1374   4301                    B=A2.                    B=NEW FAD=D7
1375      3
1376   2006                    CALL WR.                 WRITE NEW FAD
1377     20                    DEV0=1.                  INT NCU
1400      4                    DEV1=0.                  CLEAR
                        *       DONT WRITE TO EXEDEVICE
1401     23
1402   1736                    GOTO BACK.               EXIT
                        *     MODIFY WT ADDRESS
                         TOKEN.
1403    161                    BS=B.                    ROTATE 1 RT
1404    101                    B=B.                     SET COND F/FS
1405   2707                    IF LST SKIP ELSE STEP.   WT MOD ON?
1406     63
1407    716                    GOTO PID.                NO
1410    153                    B=6.                    GET D7
1411      3
1412   1666                    CALL WD.
1413      3
1414   1726                    CALL RD.
1415    111                     A2=B.                   A2=D7
1416   3004                    DEV1=96.                  ACCESS NCU
1417     33                    B=MAIL.                   MAILBOX PG
1420      3
1421   1626                    CALL PG.
1422     53                    B=2.                     WTA WD 2
1423      3
1424   1666                    CALL WD.
1425   4301                    B=A2.                    B=D7=NEW WTA
1426      3
1427   2006                    CALL WR.                 WRT NEW WTA
1430     20                    DEV0=1.                  INT NCU
1431      4                    DEV1=0.                  CLEAR
                        *       DONT WRITE TO EXEDEVICE
1432     23
1433   1736                    GOTO BACK.               EXIT
```

```
                        *       MOD. CONV. PG.
                         PID.
1434        20                    DEVO=1.                     INT NCU
1435       161                    BS=B.                       ROTATE 1 RT
1436       101                    B=B.                        SET COND F/FS
1437      2707                    IF LST SKIP ELSE STEP.      CONV BIT ON?
1440       123
1441      3776                    GOTO INQ.                   NO, EXIT
1442       153                    B=6.                      GET D7
1443         3
1444      1666                    CALL WD.
1445         3
1446      1726                    CALL RD.
1447       111                    A2=B.                     A2=D7
1450       173                    B=7.                        WD 7
1451         3
1452      1666                    CALL WD.
1453         3
1454      1726                    CALL RD.                    GET D8
1455       115                    A3=B.                       A3=D8
1456        33                    B=TABL.                     CONV TABL PG
1457         3
1460      1626                    CALL PG.
1461      4301                    B=A2.                       WD D7
1462         3
1463      1666                    CALL WD.                    LID TO BE CHANGED
1464      6301                    B=A3.                       B=D8.
1465         3
1466      2006                    CALL WR.                     WRITE NEW FAD
                        *         DONT WRITE TO EXODEVICE
1467        23
1470      1736                    GOTO BACK.                  EXIT
                         NACM.                              NOT CONTROL
1471         4                    DEV1=0.
1472        20                    DEVO=1.                             INT NCU-RD
1473       123
1474      3776                    GOTO INQ.                           EXIT
                        *
                        *
                        *        *** #4 NCU WRITEO INT MODULE ***
                        *
                         INTO.
1475       607                    STEP.
1476       607                    STEP.
                        *                 GET WRITE ADDR
1477         4                    DEV1=0.                             CLEAR
1500        13                    B=WKPG.                             WKPG
1501         3
1502      1626                    CALL PG.
1503      1373                    B=IQFR.
1504         3
1505      1666                    CALL WD.
1506         3
1507      1726                    CALL RD.
1510       105                    A1=B.                     A1=IQFR
1511         3
1512      1626                    CALL PG.
1513       113                    B=4.
1514         3
1515      1666                    CALL WD.
```

```
1516      3
1517   1726          CALL RD.
1520    115          A3=B.                    A3=D5
1521     33          B=TABL.
1522      3
1523   1626          CALL PG.
1524   6301          B=A3.
1525      3
1526   1666          CALL WD.
1527      3
1530   1726          CALL RD.
1531    115          A3=B.                    A3=WRT ADDR
1532   3004           DEV1=96.                        ACCESS NCU
1533     33          B=MAIL.                         PG 1 MAILBOX
1534      3
1535   1626          CALL PG.
1536     33          B=WRA.
1537      3
1540   1666          CALL WD.
1541   6301          B=A3.
1542      3
1543   2006          CALL WR.
1544    113          B=ICIE.                  CIE INT WD
1545      3
1546   1666          CALL WD.                 WD #4
1547     33          B=ONE.
1550      3
1551   2006          CALL WR.                 SET ICIE=1 WRTO
1552     20          DEV0=1.                  INT NCU
1553      4          DEV1=0.                  CLEAR
1554   2301          B=A1.                   IQFR
1555      3
1556   1626          CALL PG.                 PG IQFR
1557     13          B=ZERO.
1560      3
1561   1666          CALL WD.
1562      3
1563   1726          CALL RD.
1564    115          A3=B.
1565   2533          B=IC1.
1566   6401          B=A3 EQV B.
1567   3707          IF ABT SKIP ELSE STEP.
1570    123
1571   3776          GOTO INQ.
1572      3
1573   1726          CALL RD.
1574    115          A3=B.
1575   5253          B=IC2.
1576   6401          B=A3 EQV B.
1577   3707          IF ABT SKIP ELSE STEP.
1600    123
1601   3776          GOTO INQ.
1602      3
1603   1026          CALL LPC.                          CK LPC
1604   2305          A1=A1.
1605   2345          REX1 A1=A1.
1606   2401          B=A1 EQV B.
1607   3707          IF ABT SKIP ELSE STEP.
1610    123
1611   3776          GOTO INQ.
```

```
1612      53                    B=2.                    WD #2
1613       3
1614    1666                    CALL WD.                GET D3
1615       3
1616    1726                    CALL RD.
1617     161                    BS=B.                   ROTATE 4 TIMES RT
1620     161                    BS=B.
1621     161                    BS=B.
1622     161                    BS=B.
1623     101                    B=B.                    SET COND F/FS
1624    2707                    IF LST SKIP ELSE STEP.  LST ON?
1625     123
1626    3776                    GOTO INQ.               NO, EXIT
                        *        CHANGE CONVERSION TABLE
1627     153                    B=6.                    GET D7
1630       3
1631    1666                    CALL WD.
1632       3
1633    1726                    CALL RD.
1634     111                    A2=B.                   A2=LID TO CHANGE
1635       3
1636    1726                    CALL RD.                GET D8
1637     115                    A3=B.                   A3=NEW FAD
1640      33                    B=TABL.
1641       3
1642    1626                    CALL PG.                CONVERSION TABLE
1643    4301                    B=A2.                   WD=LID
1644       3
1645    1666                    CALL WD.
1646    6301                    B=A3.                   WRITE NEW FAD
1647       3
1650    2006                    CALL WR.
                        *          DONT WRITE TO EXODEVICE
1651      23
1652    1736                    GOTO BACK.              EXIT TO BACK
                        *
                        *
                        *        *** #5 OUTPUT Q HANDLER MODULE ***
                        *
                         OUTQ.                          OUTPUT Q MODULE
1653     607                    STEP.
1654     607                    STEP.
1655       4                    DEV1=0.                 CLEAR
1656    6355                    BEX3 A3=A3.             GET CLK TM
1657     105                    A1=B.                   A1=CLKTM
1660      13                    B=WKPG.                 PUT A1 INTO
1661       3
1662    1626                    CALL PG.                LSTWT
1663    1533                    B=LSTWT.                ON WKPG
1664       3
1665    1666                    CALL WD.
1666    2301                    B=A1.
1667       3
1670    2006                    CALL WR.
1671      53                    B=BLDR.
1672       3
1673    1626                    CALL PG.
1674     133                    B=AKS.
1675       3
1676    1666                    CALL WD.
```

```
1677     3
1700  1726              CALL RD.
1701   105              A1=B.
1702   401              B=0 EQV B.
1703  3707              IF ABT SKIP ELSE STEP. AKS=0?
1704    63
1705  6456              GOTO MOVE.              NO
1706  3004              DEV1=96.                      YES
1707    33              B=MAIL.
1710     3
1711  1626              CALL PG.
1712   133              B=AKS.
1713     3
1714  1666              CALL WD.
1715    13              B=ZERO.
1716     3
1717  2006              CALL WR.
1720   103
1721  1516              GOTO PKT.
                  MOVE.
1722  2205              A1=A1+1.
1723   133              B=AKS.
1724     3
1725  1666                CALL WD.
1726  2301              B=A1.
1727     3
1730  2006              CALL WR.
1731   113              B=4.                    GET AKFR
1732     3
1733  1666              CALL WD.
1734     3
1735  1726              CALL RD.
1736   105              A1=B.                   A1=VAKFR
1737     3
1740  1666              CALL WD.
1741  7773              B=255.
1742  2605              A1=A1-B.
1743    13              B=ZERO.
                  LRZE.
1744     3
1745  2006              CALL WR.                      WRT ZEROS
1746  2205              A1=A1+1.
1747  3707              IF ABT SKIP ELSE STEP.
1750    63
1751  7116              GOTO LRZE.
1752  7753              B=254.                  WD 254=EOP
1753     3
1754  1666              CALL WD.
1755  7773               B=EOP.
1756     3
1757  2006              CALL WR.
1760  1521              OUTO=0.
1761   607              STEP.
1762  3004              DEV1=96.
1763    33              B=MAIL.                       MV MAIL PARS
1764     3
1765  1626              CALL PG.
1766    13              B=ZERO.
1767     3
1770  1666              CALL WD.
```

```
1771      3
1772   1726                    CALL RD.
1773    105                    A1=B.
1774      3
1775   1726                    CALL RD.
1776    111                    A2=B.
1777      3
2000   1726                    CALL RD.
2001    115                    A3=B.
2002      4                    DEV1=0.
2003     53                    B=BLDR.
2004      3
2005   1626                    CALL PG.
2006     13                     B=ZERO.
2007      3
2010   1666                    CALL WD.
2011   2301                    B=A1.
2012      3
2013   2006                    CALL WR.
2014   4301                    B=A2.
2015      3
2016   2006                    CALL WR.
2017   6301                    B=A3.
2020      3
2021   2006                     CALL WR.
2022     13                    B=VINCU.
2023      3
2024   2006                    CALL WR.
2025     13                    B=ZERO.
2026      3
2027   1666                    CALL WD.
2030   3004                    DEV1=96.                BLDR-MAIL XFER
2031     33                    B=ONE.
2032      3
2033   1626                    CALL PG.
2034     13                    B=ZERO.
2035      3
2036   1666                    CALL WD.
2037   3204                    DEV1=104.
2040      3
2041   2046                    CALL BLAST.
2042      4                     DEV1=0.
2043   1521                    OUTO=0.
2044    607                    STEP.
2045     53                    B=BLDR.
2046      3
2047   1626                    CALL PG.
2050     73                    B=3.
2051      3
2052   1666                    CALL WD.
2053    153                    B=VAKCUR.
2054      3
2055   2006                    CALL WR.
2056    153                    B=VAKFR.                INIT BLDR PG
2057      3
2060   2006                    CALL WR.
2061     13                    B=VAKS.
2062      3
2063   2006                    CALL WR.
                          PKT.
```

```
2064        4                DEV1=0.                  CLEAR
2065       13                B=WKPG.
2066        3
2067     1626                CALL PG.
2070     1473                B=OQFR,
2071        3
2072     1666                CALL WD.
2073        3
2074     1726                CALL RD.
2075      401                B=0 EQV B.
2076     3707                IF ABT SKIP ELSE STEP. PACK BEEN SENT?
2077      103
2100     2256                 GOTO WORD2.            YES
2101     1433                B=OQNOW.
2102        3
2103     1666                CALL WD.
2104        3
2105     1726                CALL RD.
2106      401                B=0 EQV B.               OQNOW=0?
2107     3707                IF ABT SKIP ELSE STEP.
2110      103
2111     3216                GOTO TOPQ.               NO
                    WORD2.                             YES,Q EMPTY
2112     3004                DEV1=96.                 ACCESS NCU
2113       53                B=2.                     PG 2-OUTPUT PG
2114        3
2115     1626                CALL PG.
2116     7733                B=253.                   WD 253
2117        3
2120     1666                CALL WD.
2121       13                B=ZERO.                  =0 TO INDICATE
2122        3
2123     2006                CALL WR.                 EMPTY PAGE
2124        3
2125     2006                CALL WR.                 WD 254=0
2126       33                B=MAIL.
2127        3
2130     1626                CALL PG.
2131       53                B=WTA.
2132        3
2133     1666                CALL WD.
2134        3
2135     1726                CALL RD.
2136      105                A1=B.
2137       33                B=WRA.
2140        3
2141     1666                 CALL WD.
2142     2301                 B=A1.
2143        3
2144     2006                CALL WR.
2145        4                DEV1=0.                  RETURN CIE MEM
2146      143
2147     6056                GOTO INT1-2.             EXIT
                    TOPQ.
2150       13                B=WKPG.                  VALID TOP OF Q
2151        3
2152     1626                CALL PG.                 WKPG
2153      333                B=VOQTOP.                 GET OQTOP
2154      111                A2=B.                    A2=OQTOP
2155     4301                B=A2.                    PG OQTOP
```

```
2156        3
2157     1626                 CALL PG.
                    *                 SET LPC
2160        3
2161     1026                 CALL LPC.
2162     2331                  OUT2=A1.
2163      607                 STEP.
2164      113                 B=4.            GET D5
2165        3
2166     1666                 CALL WD.
2167        3
2170     1726                 CALL RD.
2171      105                 A1=B.                     A1=D5
2172       33                 B=TABL.                   PG TABL
2173        3
2174     1626                 CALL PG.
2175     2301                 B=A1.
2176        3
2177     1666                 CALL WD.                  WD D5
2200        3
2201     1726                 CALL RD.
2202      115                 A3=B.                     A3=FAD
2203     4301                 B=A2.                     GET D3
2204        3
2205     1626                 CALL PG.                  PG OQTOP
2206       53                 B=2.                      WD 2
2207        3
2210     1666                 CALL WD.
2211        3
2212     1726                 CALL RD.
2213      161                 BS=B.                     SHIFT RT
2214      161                 BS=B.                     5 TMS
2215      161                 BS=B.
2216      161                 BS=B.
2217      161                 BS=B.
2220      101                 B=B.                      SET COND F/FS
2221     2707                 IF LST SKIP ELSE STEP.    ALT ROUTE?
2222      103
2223     4756                 GOTO NORM.                NO
2224       33                 B=VALT1.                YES
2225     6415                 A3=A3 EQV B.              ALT1=FAD?
2226     3627                 IF ABT STEP ELSE SKIP.
2227      103
2230     4716                 GOTO DFFF.                YES
2231      115                 A3=B.                     NO,SET FAD=ALT1
2232      103
2233     4756                 GOTO NORM.
                    DFFF.
2234       73                 B=VALTO.
2235      115                 A3=B.
                    NORM.
2236     3004                 DEV1=96.                  ACCESS NCU
2237       33                 B=MAIL.                   MAIL PG
2240        3
2241     1626                 CALL PG.
2242       33                 B=ONE.                    WD 1
2243        3
2244     1666                 CALL WD.
2245     6301                 B=A3.                     SET WRITE ADDR
2246        3
```

```
2247    2006            CALL WR.
2250       4            DEV1=0.                 RTN TO CIE MEM
2251    4301            B=A2.                   PG OQTOP
2252       3
2253    1626            CALL PG.
2254    7733            B=253.                  WD 253
2255       3
2256    1666            CALL WD.
2257       3
2260    1726            CALL RD.
2261     101            B=R.                    SET COND F/FS
2262    3627            IF ABT STEP ELSE SKIP.  253=EOP?
2263     103
2264    5616            GOTO MVBL.              YES
2265    7773            B=EOP.                  NO
2266       3
2267    2006            CALL WR.                SET 254=EOP
                *         DO BLAST TRANSFER
                 MVBL.
2270    4301            B=A2.                   PG OQTOP
2271       3
2272    1626            CALL PG.                WD 0
2273      13            B=ZERO.
2274       3
2275    1666            CALL WD.
2276    3004            DEV1=96.                ACCESS NCU
2277      53            B=2.                    PG 2 - NCU
2300       3
2301    1626            CALL PG.                WD 0
2302      13            B=ZERO.
2303       3
2304    1666            CALL WD.
2305    3204            DEV1=104.               BLAST CIE-NCU
2306       3
2307    2046            CALL BLAST.             BLAST TRANSFER
2310       4            DEV1=0.                 CLEAR
2311    1521            OUTO=0.
2312     607            STEP.
2313    6355            REX3 A3=A3.             GET CLK TM
2314     105            A1=R.                   A1=CLK TM
2315      13            B=WKPG.                 WKPG
2316       3
2317    1626            CALL PG.                SET OQ TM SENT
2320    6273            B=203.                  INDICATOR
2321       3
2322    1666            CALL WD.
2323    2301            B=A1.
2324       3
2325    2006            CALL WR.
2326    3173            B=103.
2327       3
2330    1666            CALL WD.
2331    4004            DEV1=128.               DISABLE MAR INCR
2332       3
2333    1726            CALL RD.
2334       1            B=R + 1.                INCR OQ #TMS
2335       3
2336    2006            CALL WR.                SENT INDICATOR
                *           SET PACKET WAIT FOR ACK
2337    1473            B=OQFR.
```

```
2340        3
2341     1666                CALL WD.
2342       33                B=ONE.
2343        3
2344     2006                CALL WR.
2345        4                DEV1=0.                    CLEAR
2346      143
2347     6056                GOTO INT1-2.            EXIT
                    *
                    *         *** #6 OUTSTANDING ACK HAND MODULE  ***
                    *          NO ACKS ON BROADCASTS
                    *
                     OUTAK.
2350      607                STEP.
2351      607                STEP.
2352        4                DEV1=0.
2353       13                B=WKPG.
2354        3
2355     1626                CALL PG.
2356     1433                B=OQNOW.
2357        3
2360     1666                CALL WD.
2361        3
2362     1726                CALL RD.
2363      401                B=0 EQV B.
2364     3627                IF ABT STEP ELSE SKIP. PACK PRES?
2365       23
2366     1736                GOTO BACK.
2367     1473                B=OQFR.
2370        3
2371     1666                CALL WD.
2372        3
2373     1726                CALL RD.
2374      401                B=0 EQV B.
2375     3627                IF ABT STEP ELSE SKIP. WAITING?
2376       23
2377     1736                GOTO BACK.              JUNK REC
2400     1373                B=IQFR.
2401        3
2402     1666                CALL WD.
2403        3
2404     1726                CALL RD.
2405      115                A3=B.
2406        3
2407     1626                CALL PG.
2410       53                B=2.                    GET D3
2411        3
2412     1666                CALL WD.
2413        3
2414     1726                CALL RD.
2415      101                B=B.
2416     2707                IF LST SKIP ELSE STEP. ACK?
2417      123
2420     1056                GOTO NNACK.             NO
2421       13                B=WKPG.                         YES
2422        3
2423     1626                CALL PG.
2424     1433                B=OQNOW.                        SET OQNOW,OQFR=0
2425        3
2426     1666                CALL WD.
```

```
2427      13                B=ZERO.
2430       3
2431    2006                CALL WR.
2432    1473                B=OOFR.
2433       3
2434    1666                CALL WD.
2435      13                B=ZERO.
2436       3
2437    2006                CALL WR.
2440      23
2441    1736                GOTO BACK.              EXIT
                      NNACK.
2442      13                B=WKPG.
2443       3
2444    1626                CALL PG.
2445    3173                B=103.
2446       3
2447    1666                CALL WD.                          GET #TMS SNT
2450       3
2451    1726                CALL RD.
2452     105                A1=B.
2453      73                B=VMAXTR.                         GET MAX
2454    2405                A1=A1 EQV B.            #TMS=MAX?
2455    3707                IF ABT SKIP ELSE STEP.
2456     123
2457    3576                 GOTO RRLNKS.           NO,RESEND
                      *             YES, ALT ROUTE ROUTINE HERE
2460     333                B=VOQTOP.
2461     125                OUT1=B.
2462      53                B=2.
2463     121                OUT0=B.
2464    2305                A1=A1.
2465    2345                 BEX1 A1=A1.
2466     105                A1=B.                   A1=D3
2467     161                BS=B.
2470     161                BS=B.
2471     161                BS=B.
2472     161                 BS=B.
2473     161                BS=B.
2474     101                B=B.
2475    2627                IF LST STEP ELSE SKIP. ALTRT USED?
2476     123
2477    3176                GOTO KLLPAC.
2500     113                B=4.
2501     121                OUT0=B.
2502    2305                A1=A1.
2503    2345                BEX1 A1=A1.
2504     111                 A2=B.                   A2=D5
2505      33                 B=TABL.
2506     125                OUT1=B.
2507    4301                B=A2.
2510     121                OUT0=B.
2511    2305                A1=A1.
2512    2345                BEX1 A1=A1.
2513     111                A2=B.                   A2=WRT ADDR
2514      33                B=VALT1.
2515    4401                B=A2 EQV B.             A2=VALT1?
2516    3627                IF ABT STEP ELSE SKIP.
2517     123
2520    2556                GOTO ALTROK.            YES, OK
```

```
2521      73                    B=VALTO.
2522    4401                    B=A2 EQV B.             A2=VALTO?
2523    3707                    IF ABT SKIP ELSE STEP.
2524     123
2525    3176                    GOTO KLLPAC.            NO ALTRT
                        ALTROK.
2526    1013                    B=32.
2527    2105                     A1=A1+B.
2530     333                     B=VOQTOP.
2531     125                    OUT1=B.
2532      53                    B=2.
2533     121                    OUT0=B.
2534    2331                    OUT2=A1.
2535     607                     STEP.
2536      13                    B=WKPG.
2537     125                    OUT1=B.
2540    3173                    B=103.
2541     121                    OUT0=B.
2542      13                    B=ZERO.
2543     131                    OUT2=B.
2544     607                    STEP.
2545     123
2546    3576                    GOTO RRLNKS.
                        KLLPAC.
2547      13                    B=WKPG.
2550     125                     OUT1=B.
2551    1433                    B=OQNOW.
2552       3
2553    1666                    CALL WD.                        DESTROY PACK
2554      13                    B=ZERO.
2555       3
2556    2006                    CALL WR.
2557    1473                    B=OQFR.
2560       3
2561    1666                    CALL WD.
2562      13                    B=ZERO.
2563       3
2564    2006                    CALL WR.
2565      23
2566    1736                    GOTO BACK.
                        RRLNKS.
2567    1473                    B=OQFR.
2570       3
2571    1666                    CALL WD.
2572      13                    B=ZERO.
2573       3
2574    2006                    CALL WR.
2575      23
2576    1736                    GOTO BACK.
                      *                 *** #8 CIE TO INPUT QUEUE HANDLER ***
                        INQ.
2577     607                    STEP.
2600     607                    STEP.
2601       4                    DEV1=0.
2602      13                    B=WKPG.
2603       3
2604    1626                    CALL PG.
2605    1373                    B=IQFR.
2606       3
2607    1666                    CALL WD.
```

```
2610        3
2611     1726                 CALL RD.
                      *              IF HDR HAS EOP THROW AWAY PACK
2612        3
2613     1626                  CALL PG.
2614       33                 B=ONE.
2615        3
2616     1666                  CALL WD.
2617        3
2620     1726                 CALL RD.
2621      115                 A3=B.                    A3=D2
2622      101                 B=B.
2623     3627                 IF ABT STEP ELSE SKIP.
2624       23
2625     1736                 GOTO BACK.
2626        3
2627     1726                 CALL RD.                          D3
2630      101                 B=B.
2631     3627                 IF ABT STEP ELSE SKIP.
2632       23
2633     1736                 GOTO BACK.
2634        3
2635     1726                 CALL RD.                          D4
2636      101                 B=B.
2637     3627                 IF ABT STEP ELSE SKIP.
2640       23
2641     1736                 GOTO BACK.
2642        3
2643     1726                  CALL RD.                         D5
2644      101                 B=B.
2645     3627                 IF ABT STEP ELSE SKIP.
2646       23
2647     1736                 GOTO BACK.
2650        3
2651     1726                   CALL RD.               D6
2652      111                 A2=B.                    A2=D6
2653      101                 B=B.
2654     3627                 IF ABT STEP ELSE SKIP.
2655       23
2656     1736                  GOTO BACK.
2657       13                 B=ZERO.                    WD 0
2660      121                 OUTO=B.
2661        3
2662     1026                 CALL LPC.                  FORM LPC IN A1
2663     2305                 A1=A1.
2664     2345                 BEX1 A1=A1.                GET LPC WD
2665     4607                 IF LC1 STEP.               RESETS LC1
2666     2401                 B=A1 EQV B.                LPC OK?
2667     3707                 IF ABT SKIP ELSE STEP.
2670      123
2671     7116                 GOTO CSTPP.                NO
2672      201                 B=1.                       YES
2673     2007                 IF LST SET LC1 STEP.       SET LC1
2674       53                 B=2.
2675      607                 STEP.
2676        3
2677     1666                 CALL WD.
2700        3
2701     1726                 CALL RD.
2702      161                 BS=B.
```

```
2703     101                    B=B.
2704    2627                    IF LST STEP ELSE SKIP. R/S MODE?
2705     143
2706    5016                    GOTO IQLINK.          YES
2707    1113                    B=36.                 PG 36-LST MSG
2710       3
2711    1626                    CALL PG.
2712    4301                    B=A2.                 WD D6
2713       3
2714    1666                    CALL WD.
2715       3
2716    1726                    CALL RD.
2717    6401                    B=A3 EQV B.           =LST MSGNO?
2720    3627                    IF ABT STEP ELSE SKIP.
2721      23
2722    1736                    GOTO BACK.            YES REJECT
2723    4301                    B=A2.                 NO, OK
2724       3
2725    1666                    CALL WD.
2726    6301                    B=A3.
2727       3
2730    2006                    CALL WR.
2731      13                     B=WKPG.
2732       3
2733    1626                    CALL PG.
2734    1373                    B=IQFR.
2735       3
2736    1666                    CALL WD.
2737       3
2740    1726                    CALL RD.
2741     115                    A3=B.                 A3=VIQFR
2742       3
2743    1626                    CALL PG.
                        CSTPP.
2744     133                    B=5.                  WD. 5
2745     121                    OUT0=B.
2746    2305                    A1=A1.
2747    2345                    BEX1 A1=A1.
2750     105                    A1=B.                   A1=D6
2751      33                    B=TABL.                 CONV TABL PG
2752     125                    OUT1=B.                 PG 4
2753    2321                    OUT0=A1.                WD D6
2754    2305                    A1=A1.
2755    2345                    BEX1 A1=A1.
2756     105                    A1=B.                   A1=D0=FAD=WRT ADDR
2757    6325                    OUT1=A3.                PG IQFR
2760      53                    B=2.                    WD 2
2761     121                    OUT0=B.
2762    2305                    A1=A1.
2763    2345                    BEX1 A1=A1.             B=D3
2764     161                    BS=B.                   SHIFT RT
2765     161                    BS=B.                   5 TIMES
2766     161                    BS=B.
2767     161                    BS=B.
2770     161                    BS=B.
2771     101                    B=B.                    SET COND F/FS
2772    2707                    IF LST SKIP ELSE STEP.  ALT ROUT USED?
2773     143
2774     216                    GOTO DO.                N/
                        ALT.                           YES
```

```
2775      33                B=VALT1.                YES
2776     111                A2=B.                     A2=UST ROUTE
2777    2401                B=A1 EQV B.               A1=A2?
3000    3627                IF ABT STEP ELSE SKIP.
3001     143
3002     156                GOTO OTHR.              YES
3003    4305                A1=A2.                  NO
3004     143
3005     216                GOTO DO.                DO=1ST ROUTE=A1
                      OTHR.
3006      73                B=VALTO.
3007     105                A1=B.
                      DO.
3010      53                B=BLDR.                 PG 5
3011     125                OUT1=B.                 ACK/NAK BLDR
3012     113                B=AKFR.                 WD 4
3013     121                OUTO=B.                 AKFR
3014    2305                A1=A1.
3015    2345                BEX1 A1=A1.
3016     111                A2=B.                     A2=AKFR
3017    4321                OUTO=A2.                  WD#=AKFR
3020    2301                B=A1.                   WRITE DO TO BLDR
3021       3
3022    2006                CALL WR.
3023    6325                OUT1=A3.                  PG IOFR
3024     133                B=5.                    WD #5
3025     121                OUTO=B.                   D6
3026    2305                A1=A1.
3027    2345                BEX1 A1=A1.
3030     105                A1=B.                     A1=D6
3031      53                L=BLDR.                    PUT D6
3032     125                OUT1=B.                   AS D5
3033    4211                A2=A2 + 1.                ON BLDR
3034     113                B=4.
3035    4121                OUTO=A2+B.                  PAGE
3036    2301                B=A1.
3037       3
3040    2006                CALL WR.
3041    6325                OUT1=A3.                  GET D5
3042     113                B=4.                    & PUT A5
3043     121                OUTO=B.                   D6 ON
3044    2305                A1=A1.                    BLDR PG
3045    2345                BEX1 A1=A1.
3046     105                A1=B.
3047      53                B=BLDR.
3050     125                OUT1=B.
3051    4211                A2=A2 + 1.
3052     113                B=4.
3053    4121                OUTO=A2+B.
3054    2301                B=A1.
3055       3
3056    2006                CALL WR.
3057    4627                IF LC1 STEP ELSE SKIP.  LPC OK?
3060     143
3061    1536                GOTO ACK.               YES, BLD ACK
3062    4013                B=128.                  NO, BLD NAK
3063     143
3064    1576                GOTO AKNK.
                      ACK.
3065     201                B=1.                      SET LC1
```

```
3066    2007                    IF LST SET LC1 STEP.
                        AKNK.
3067    4211                    A2=A2 + 1.              WRT D3=B
3070    4321                    OUT0=A2.
3071       3
3072    2006                    CALL WR.
3073    4211                    A2=A2+1.              SET D4=0
3074      13                    B=ZERO.
3075       3
3076    2006                    CALL WR.
3077    6325                    OUT1=A3.               MOVE D1
3100      13                    B=ZERO.
3101     121                    OUT0=B.
3102    2305                    A1=A1.
3103    2345                    BEX1 A1=A1.
3104     105                    A1=B.
3105      53                    B=BLDR.
3106     125                    OUT1=B.
3107    4211                    A2=A2 + 1.
3110     113                    B=4.
3111    4621                    OUT0=A2-B.
3112    2301                    B=A1.
3113       3
3114    2006                     CALL WR.
3115    6325                    OUT1=A3.              MOVE D2
3116      33                    B=ONE.
3117     121                    OUT0=B.
3120    2305                    A1=A1.
3121    2345                    BEX1 A1=A1.
3122     105                    A1=B.
3123      53                    B=BLDR.
3124     125                    OUT1=B.
3125    4211                    A2=A2 + 1.
3126     113                    B=4.
3127    4621                    OUT0=A2-B.
3130    2301                    B=A1.
3131       3
3132    2006                    CALL WR.
3133    7773                    B=EOP.                FORM D7=EOP
3134    4211                    A2=A2 + 1.
3135    4321                    OUT0=A2.
3136       3
3137    2006                    CALL WR.
3140    1505                    A1=0.                 INIT LPC
3141     113                    B=AKFR.               GET AKFR
3142     121                    OUT0=B.
3143    2305                    A1=A1.
3144    2345                    BEX1 A1=A1.
3145       1                    B=B+1.
3146     121                    OUT0=B.               WD=AKFR+1
3147     153                    B=6.
3150     115                    A3=B.
                        ALPCK.
3151    2305                    A1=A1.
3152    2345                    BEX1 A1=A1.
3153    2505                    A1=A1 XOR B.
3154    6215                    A3=A3+1.
3155    3627                    IF ABT STEP ELSE SKIP.
3156     143
3157    3616                    GOTO NOAEOP.
```

```
3160     111                A2=B.
3161    7773                B=EOP.
3162    4411                A2=A2 EQV B.
3163    3707                IF ABT SKIP ELSE STEP.
3164     143
3165    3236                GOTO ALPCK.
3166     143
3167    4136                GOTO SUCEOP.
                    NOAEOP.
3170     113                B=AKFR.
3171       3
3172    1666                CALL WD.
3173       3
3174    1726                CALL RD.
3175     111                A2=B.
3176     173                B=7.
3177    4101                B=A2+B.
3200       3
3201    1666                CALL WD.
3202    7773                B=EOP.
3203       3
3204    2006                CALL WR.
                    SUCEOP.
3205    2301                 B=A1.                  WRITE LPC
3206       3
3207    2006                CALL WR.
3210     113                B=AKFR.                  GET AKFR
3211     121                OUT0=B.                  PUT INTO A1
3212    2305                A1=A1.
3213    2345                BEX1 A1=A1.
3214     105                A1=B.
3215     233                B=9.                    ADD 9
3216    2105                A1=A1 + B.
3217     113                B=AKFR.                  UPDATE AKFR
3220     121                OUT0=B.
3221    2301                B=A1.
3222       3
3223    2006                CALL WR.
3224     133                B=AKS.                   UPDATE AKS
3225     121                OUT0=B.
3226    4004                DEV1=128.                DISABLE AUTOINCR
3227    2305                A1=A1.
3230    2345                BEX1 A1=A1.
3231       1                B=B + 1.                 ONE MORE ACK/NAK
3232       3
3233    2006                CALL WR.
3234       4                DEV1=0.                  CLEAR
3235    4707                IF LC1 SKIP ELSE STEP.   DID LPC CK?
3236      23
3237    1736                GOTO BACK.               NO,DONT LINK PACKETT
                    IQLINK.
3240      13                B=WKPG.                  YES,LINK TO IQ
3241     125                OUT1=B.                  UPDATE CURR Q SIZE
3242    1333                B=IQNOW.                 IQNOW
3243     121                OUT0=B.
3244    4004                DEV1=128.                DISABLE AUTOINCR
3245    2305                A1=A1.
3246    2345                BEX1 A1=A1.
3247       1                B=B + 1.                 INC
3250       3
```

```
3251    2006                    CALL WR.
3252    1373                    B=IQFR.                 UPDATE IQFR
3253     121                    OUT0=B.
3254    2305                    A1=A1.
3255    2345                    BEX1 A1=A1.
3256       1                    B=B + 1.                INC
3257     105                    A1=B.                   CHECK FOR
3260     253                    B=VIQMAX.                WRAPAROUND
3261     111                    A2=B.                   A2=IQMAX
3262      73                    B=3.
3263    4111                    A2=A2 + B.              PT INTO Q
3264    2301                    B=A1.                   A1=NEW IQFR
3265    4411                    A2=A2 EQV B.            A1=A2?
3266    3627                    IF ABT STEP ELSE SKIP.
3267      73                    B=3.                    YES,RESET IQFR
3270     607                    STEP.
3271     105                    A1=B.
3272    1373                    B=IQFR.                 WD IQFR
3273     121                    OUT0=B.
3274    2301                    B=A1.
3275       3
3276    2006                    CALL WR.              WRT TO MEM
3277       4                    DEV1=0.                 CLEAR
3300      23
3301    1736                    GOTO BACK.              EXIT
                        *
                        *        *** #8 NCU INT1,2 MODULE ***
                         INT1-2.
3302     607                    STEP.
3303     607                    STEP.
3304    3004                    DEV1=96.                ACCESS NCU
3305      33                    B=MAIL.                 MAILBOX PG
3306       3
3307    1626                    CALL PG.
3310     113                    B=ICIE.                 CIE INT WD
3311       3
3312    1666                    CALL WD.
3313      13                    B=ZERO.                 SET=0
3314       3
3315    2006                    CALL WR.                WRITE1,2
3316      20                    DEV0=1.                 INT NCU
3317       4                    DEV1=0.                 ACCESS CIE MEM
3320      23
3321    1736                    GOTO BACK.
                        *
                        *        *** #9 EXT TO CIE MODULE ***
                        *
                         EXXCIE.
3322     607                    STEP.
3323     607                    STEP.
3324       4                    DEV1=0.                 CLEAR
3325      13                    B=WKPG.
3326       3
3327    1626                    CALL PG.                WORKPAGE
3330    1433                    B=OQNOW.
3331       3
3332    1666                    CALL WD.
3333       3
3334    1726                    CALL RD.
3335     401                    B=0 EQV B.
```

```
3336    3707                    IF ABT SKIP ELSE STEP.
3337      23
3340    5156                    GOTO STOTCK.
3341     333                    B=VOQTOP.
3342     105                    A1=B.                       A1=VOQTOP
3343       4                    DEV1=0.
3344    4351                    BEX2 A2=A2.
3345     333                    B=VOQTOP.
3346     125                    OUT1=B.
3347    1521                    OUT0=0.
3350     607                    STEP.
3351      44                    DEV1=2.                     BLAST EXO-CIE
3352       3
3353    2046                    CALL BLAST.                 BLAST MOVE
3354      24                    DEV1=1.                     TERMINATE BLAST
3355     607                    STEP.
3356    4351                      BEX2 A2=A2.
3357       4                    DEV1=0.                     CLEAR
3360    1521                    OUT0=0.
3361     607                    STEP.
                        *     CK IF HOST CONTROL PACKET
3362       3
3363    1726                    CALL RD.
3364     115                    A3=B.
3365    2533                    B=IC1.
3366    6401                    B=A3 EQV B.
3367    3707                    IF ABT SKIP ELSE STEP.
3370     163
3371    4216                    GOTO LNKOQ.
3372       3
3373    1726                    CALL RD.
3374     115                     A3=B.
3375    5253                    B=IC2.
3376    6401                    B=A3 EQV B.
3377    3707                    IF ABT SKIP ELSE STEP.
3400     163
3401    4216                    GOTO LNKOQ.
3402     113                    B=4.                      CK D5
3403       3
3404    1666                    CALL WD.
3405       3
3406    1726                    CALL RD.
3407     115                    A3=B.
3410     133                    B=VOLID.
3411    6401                    B=A3 EQV B.
3412    3707                    IF ABT SKIP ELSE STEP.
3413     163
3414    4216                    GOTO LNKOQ.
3415      53                    B=2.                      GET D3
3416       3
3417    1666                     CALL WD.
3420       3
3421    1726                    CALL RD.
3422     161                    BS=B.
3423     161                    BS=B.
3424     101                    B=B.
3425    2707                    IF LST SKIP ELSE STEP.
3426     163
3427    1516                    GOTO XTOK.
3430      20                    DEV0=1.
```

```
3431      34                    DEV3=1.
3432       3
3433     506                    CALL WT7MS.
3434       3
3435     506                    CALL WT7MS.
3436     335                    OUT3 AMPCR=AMPCR.
3437     335                    OUT3 AMPCR=AMPCR.
3440     153                    B=6.
3441       3
3442    1666                    CALL WD.
3443       3
3444    1726                    CALL RD.
3445     111                    A2=B.
3446    3004                    DEV1=96.
3447      33                    B=MAIL.
3450       3
3451    1626                    CALL PG.
3452      13                    B=ZERO.
3453       3
3454    1666                    CALL WD.
3455    4301                    B=A2.
3456       3
3457    2006                    CALL WR.
3460       4                    DEV1=0.
3461      20                    DEV0=1.
3462      23
3463    1736                    GOTO BACK.
                        XTOK.
3464     161                    BS=B.
3465     101                    B=B.
3466    2707                     IF LST SKIP ELSE STEP.
3467     163
3470    2676                    GOTO XCNV.
3471      20                    DEV0=1.
3472      34                    DEV3=1.
3473       3
3474     506                    CALL WT7MS.
3475       3
3476     506                     CALL WT7MS.
3477     335                    OUT3 AMPCR=AMPCR.
3500     335                    OUT3 AMPCR=AMPCR.
3501     153                    B=6.
3502       3
3503    1666                    CALL WD.
3504       3
3505    1726                    CALL RD.
3506     111                    A2=B.
3507    3004                    DEV1=96.
3510      33                    B=MAIL.
3511       3
3512    1626                    CALL PG.
3513      53                    B=2.
3514       3
3515    1666                    CALL WD.
3516    4301                    B=A2.
3517       3
3520    2006                    CALL WR.
3521     113                    B=ICIE.
3522       3
3523    1666                    CALL WD.
```

```
3524    4013                    B=128.
3525       3
3526    2006                 CALL WR.
3527      20                 DEV0=1.
3530       4                 DEV1=0.
3531      23
3532    1736                 GOTO BACK.
                        XCNV:
3533     161                 BS=B.
3534     101                 B=B.
3535    2707                 IF LST SKIP ELSE STEP.
3536      23
3537    1736                 GOTO BACK.
3540      20                 DEV0=1.
3541      34                 DEV3=1.
3542       3
3543     506                 CALL WT7MS.
3544       3
3545     506                 CALL WT7MS.
3546     335                 OUT3 AMPCR=AMPCR.
3547     335                 OUT3 AMPCR=AMPCR.
3550     153                 B=6.
3551       3
3552    1666                 CALL WD.
3553       3
3554    1726                 CALL RD.
3555     111                  A2=B.              A2=LID TO CHNG
3556       3
3557    1726                 CALL RD.
3560     115                 A3=B.
3561      33                 B=TABL.                    A3=NEW FAD
3562       3
3563    1626                 CALL PG.
3564    4301                  B=A2.
3565       3
3566    1666                 CALL WD.
3567    6301                  B=A3.
3570       3
3571    2006                 CALL WR.
3572    3004                 DEV1=96.
3573      33                  B=MAIL.
3574       3
3575    1626                  CALL PG.
3576     113                 B=ICIE.
3577       3
3600    1666                 CALL WD.
3601    4013                 B=128.
3602       3
3603    2006                 CALL WR.
3604      20                 DEV0=1.
3605       4                 DEV1=0.
3606      23
3607    1736                 GOTO BACK.
                        LNKOQ.
3610      13                 B=WKPG.
3611       3
3612    1626                 CALL PG.                WORKPAGE
3613    1433                 B=OQNOW.
3614       3
3615    1666                 CALL WD.
```

```
 3616       33                    B=ONE.
 3617        3
 3620     2006                    CALL WR.                  WRT BACK TO MEM
 3621     3173                    B=103.                  INIT #TMS SENT
 3622        3
 3623     1666                    CALL WD.
 3624       13                    B=ZERO.
 3625        3
 3626     2006                    CALL WR.
 3627        4                    DEV1=0.                   CLEAR DEV
 3630       23
 3631     1736                    GOTO BACK.                 RETURN TO BKGND MODULE
                                  END?.
THE NUMBER OF ERRORS= 0
TT0  --  STOP
>

  RSX-11M V02 BL12   32K     MAPPED
>RED DK0:=SY0:
>MOU DK0:
>@[1,2]STARTUP
>INS [1,1]M1710/PAR=M1710
>SET /UIC=[20,20]
>@ <EOF>
>
```

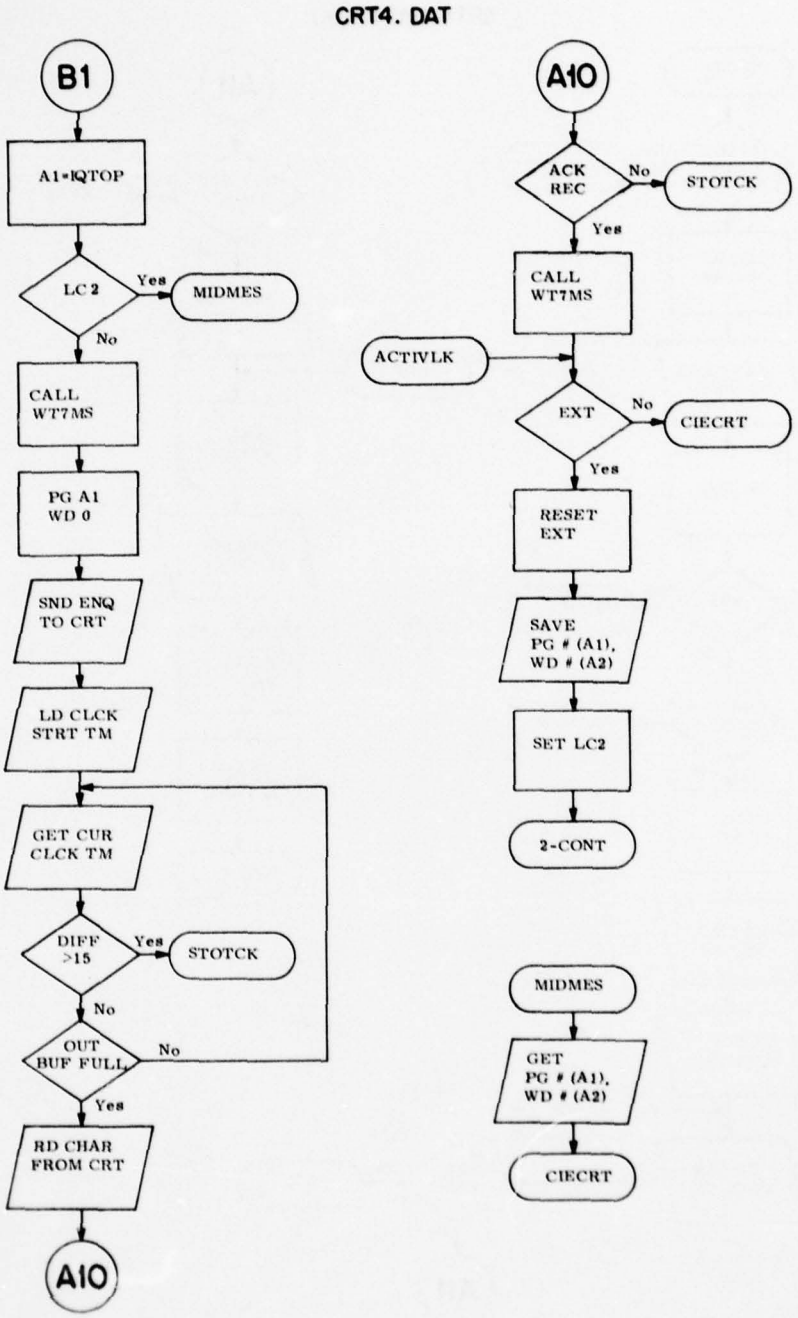


Figure 2-6. CRT4.DAT

CRT4. DAT (Cont.)

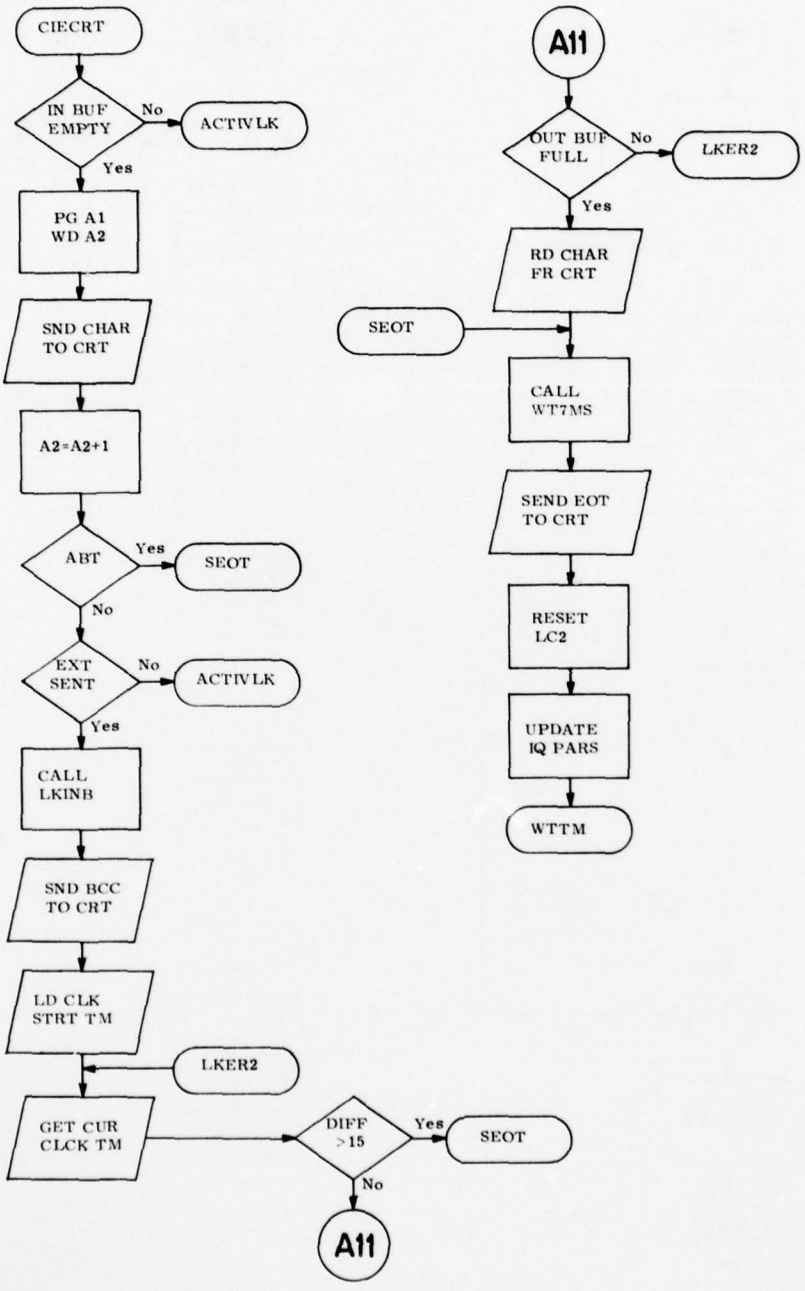


Figure 2-6. (Cont.)

CRT4. DAT (Cont.)

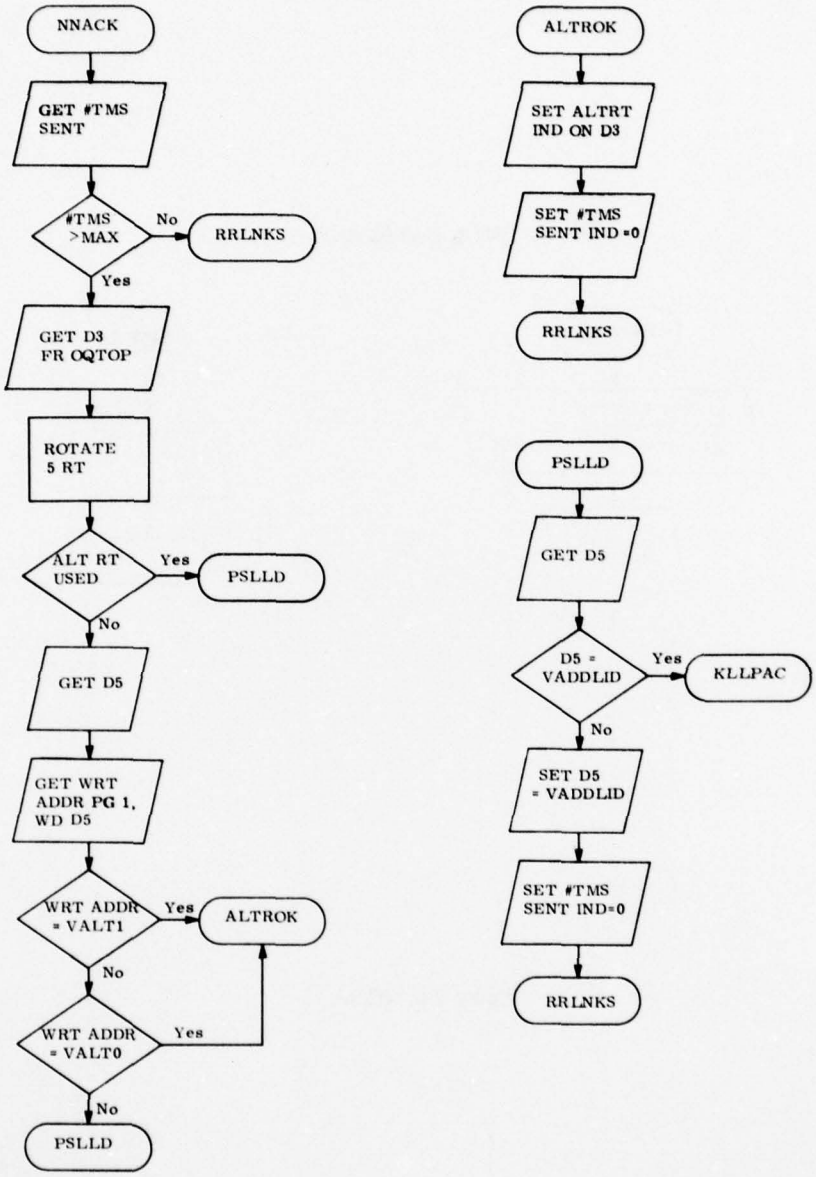


Figure 2-6. (Cont.)

CRT4. DAT (Cont.)

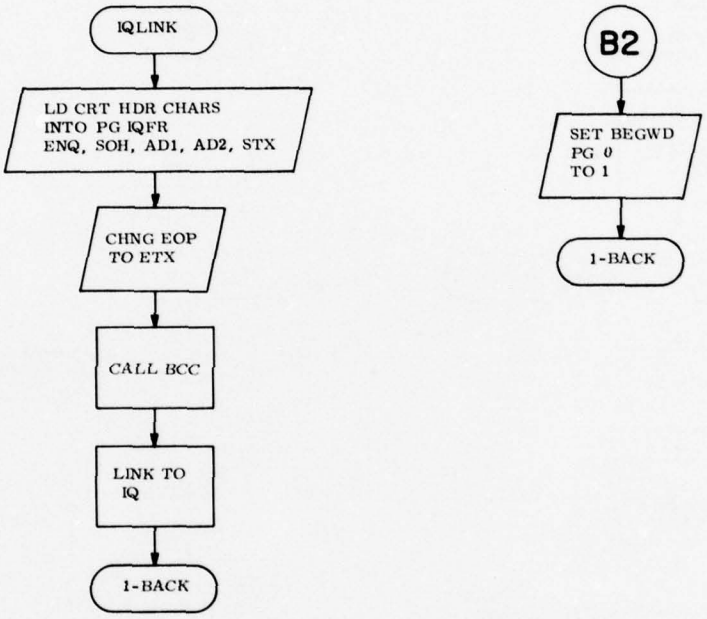


Figure 2-6. (Cont.)

CRT4. DAT (cont.)

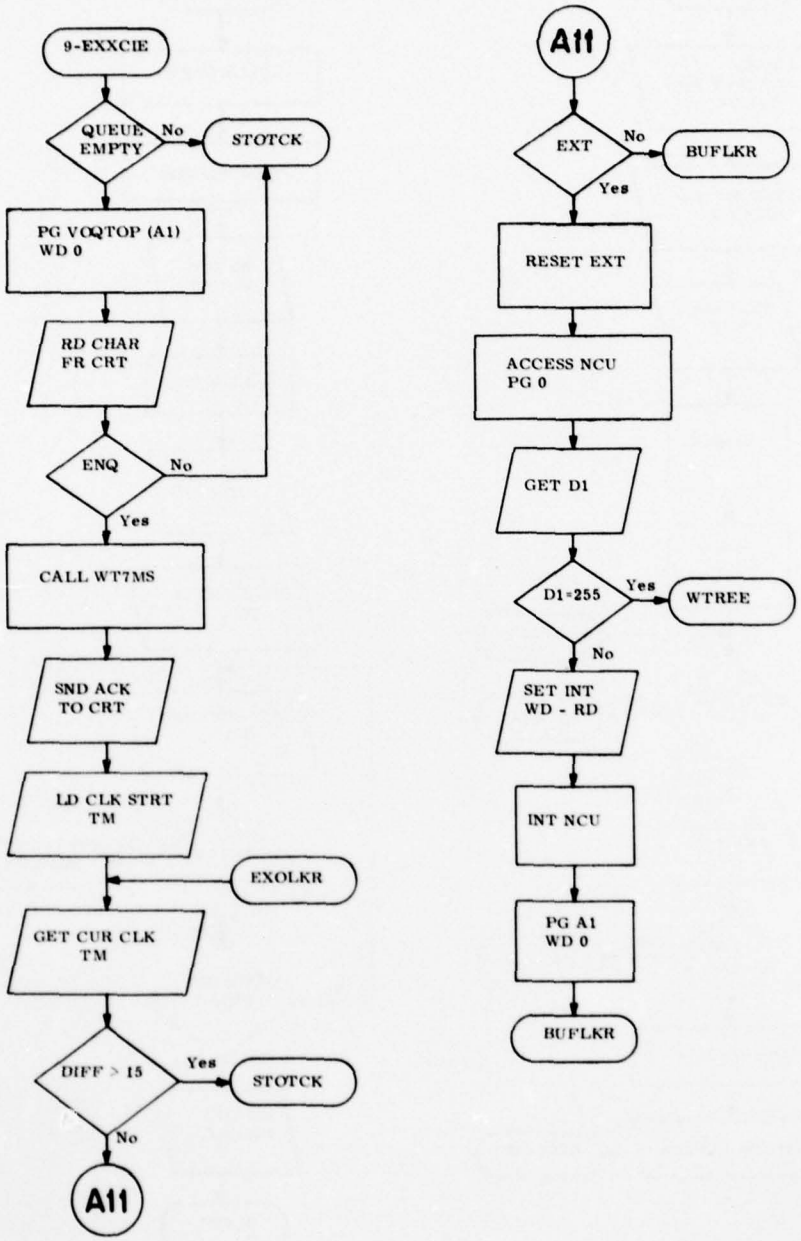


Figure 2-6. (Cont.)

CRT4. DAT (cont.)

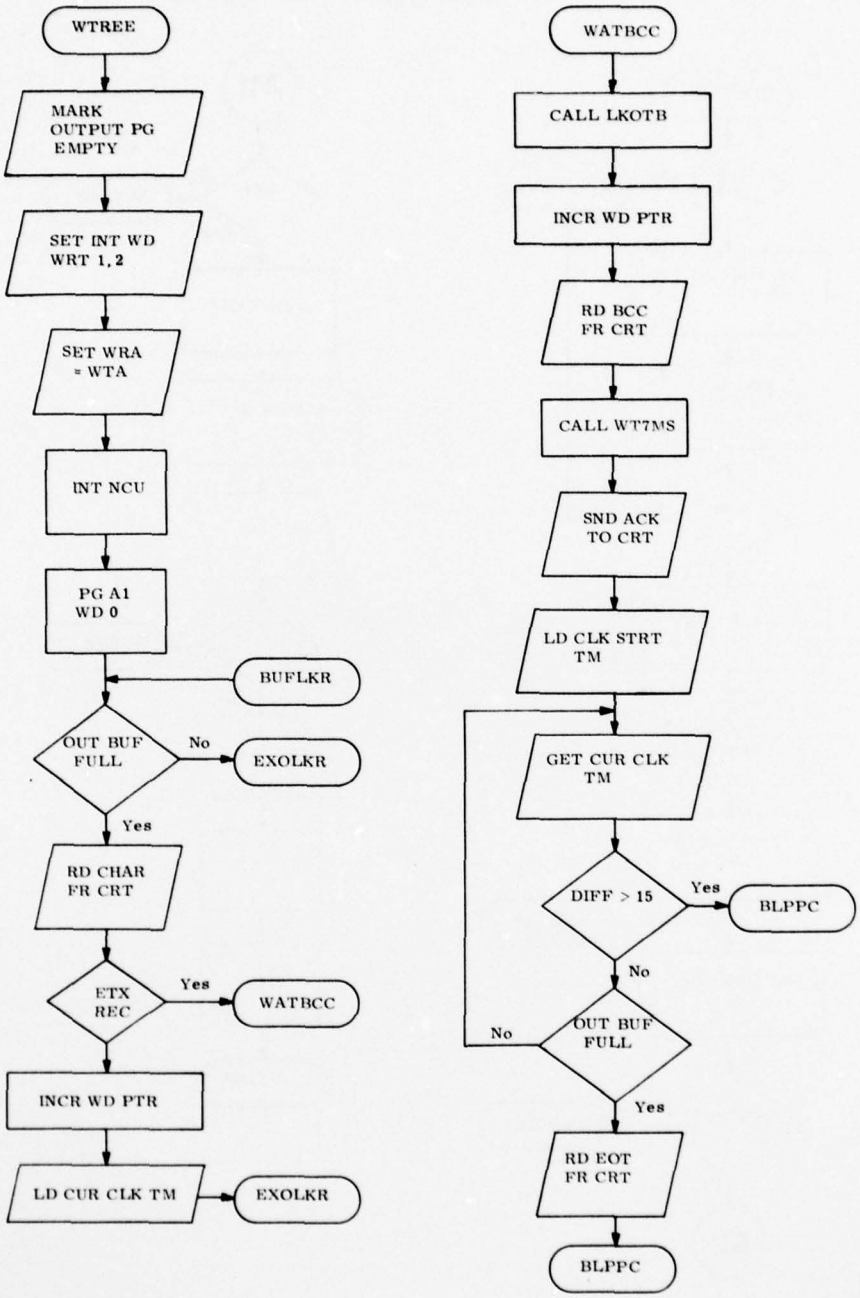


Figure 2-6. (Cont.)

CRT4. DAT (cont.)

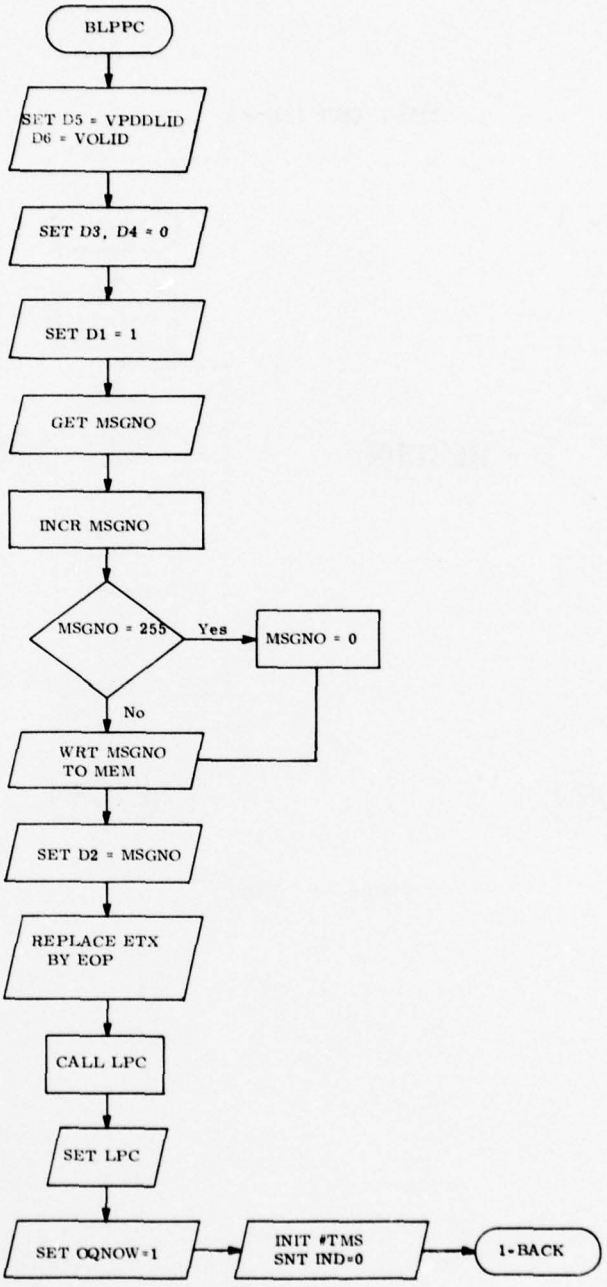


Figure 2-6. (Cont.)

CRT4. DAT (cont.)

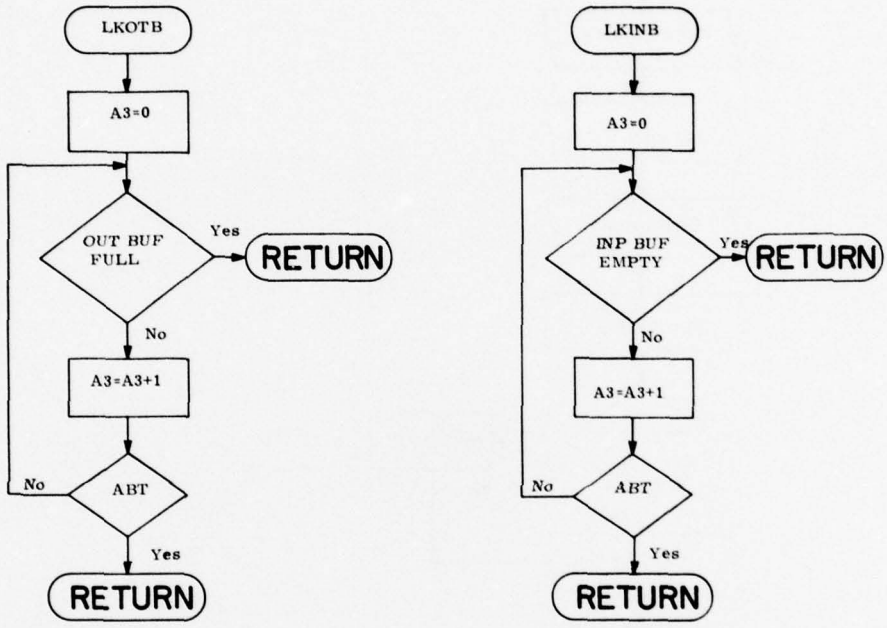


Figure 2-6. (Cont.)

```
MCR>RUN [20,20]MDMPL
PLEASE ENTER INPUT SOURCE FILE NAME
CRT4.DAT
PLEASE ENTER OUTPUT OBJECT FILE NAME
CRT4.OBJ
WAIT FOR FIRST PASS - SCAN FOR LABELS
  250 RECORDS READ
  500 RECORDS READ
  750 RECORDS READ
 1000 RECORDS READ
 1250 RECORDS READ
 1500 RECORDS READ
 1750 RECORDS READ
MPAD     CODE
```

```
                        $12BIT
                         PROGRAM-ID CIE.
                        *
                        *   **** CIE NODAL SOFTWARE ****
                        *
                         WKPG VALUE 0.
                         IQFR VALUE 47.
                         TABL VALUE 1.
                         AKFR VALUE 4.
                         BLDR VALUE 2.
                         IQNOW VALUE 45.
                         AKS VALUE 5.
                         IQMAX VALUE 44.
                         MAIL VALUE 1.
                         ICIE VALUE 4.
                         ZERO VALUE 0.
                         ONE VALUE 1.
                         EOP VALUE 255.
                         RDA VALUE 0.
                         WRA VALUE 1.
                         WTA VALUE 2.
                         INCU VALUE 3.
                         AKS VALUE 5.
                         ALT1 VALUE 0.
                         OQNOW VALUE 49.
                         OQTOP VALUE 50.
                         OQFR VALUE 51.
                         IQTOP VALUE 46.
                         BEGWD VALUE 56.
                         LSTWT VALUE 53.
                         DFFWT VALUE 54.
                         OQMAX VALUE 48.
                         D3 VALUE 2.
                         AKCUR VALUE 3.
                         LOOPNO VALUE 253.
                         SYSNO VALUE 254.
                         OLID VALUE 149.
                         MSGNO VALUE 152.
                         COUNT VALUE 180.                BLAST TIMING PARAMETER
                         VLOOPNO VALUE 4.
                         VSYSNO VALUE 11.
                         VAKCUR VALUE 6.
                         VRDA VALUE 4.
                         VWRA VALUE 2.
                         VWTA VALUE 2.
```

```
                        VINCU VALUE 0.
                        VAKS VALUE 0.
                        VAKFR VALUE 6.
                        VALT1 VALUE 1.
                        VALTO VALUE 3.
                        VIQMAX VALUE 8.
                        VIQNOW VALUE 0.
                        VIQTOP VALUE 3.
                        VIQFR VALUE 3.
                        VOQMAX VALUE 1.
                        VOQNOW VALUE 0.
                        VOQTOP VALUE 11.
                        VOQFR VALUE 0.
                        VDFFWT VALUE 12.              #TICKS
                        VMAXTR VALUE 2.
                        VMAXCK VALUE 41.              #TICKS
                        VICIE VALUE 128.
                        VOLID VALUE 4.
                        VPDDLID VALUE 5.
                        VADDLID VALUE 1.
                        ENQ VALUE 5.
                        ACK VALUE 6.
                        NAK VALUE 149.
                        SOH VALUE 129.
                        AD1 VALUE 255.
                        AD2 VALUE 255.
                        STX VALUE 130.
                        ETX VALUE 3.
                        EOT VALUE 132.
                        IC1 VALUE 85.
                        IC2 VALUE 170.                FOR CONT PACK
0       3
1    3016               GOTO INIT.
2      23
3    1436               GOTO BACK.                    HDWR ERR
                     *        DEBUG JUMPS
4      43
5    4216               GOTO CONT.
6      43
7    6636               GOTO INTRD.
10     63
11   3616               GOTO INTO.
12     63
13   7356               GOTO OUTQ.
14    123
15    416               GOTO OUTAK.
16    123
17   5516               GOTO INQ.
20    163
21   1156               GOTO INT1-2.
22    163
23   1776               GOTO EXXCIE.
                     *        LK AT OUTPUT BUF SUB
                     LKOTB.
24   1515               A3=0.                         INIT TM PAR
                     OTBL.
25     13               B=ZERO.
26    141               BEXO B=B.                              GET BUF ST REG
27    101               B=B.
30   2627               IF LST STEP ELSE SKIP.  OUT BUF FULL?
```

```
31      657                     JUMP.                   EXIT
32      607                     STEP.
33     6215                     A3=A3+1.
34     3707                     IF ABT SKIP ELSE STEP. 2 MSEC TMOUT?
35        3
36      536                     GOTO OTBL.              NO
37      657                     JUMP.                   YES,ERROR COND
                        *               LK AT INPUT BUF SUB
                         LKINB.
40     1515                     A3=0.
                         INBL.
41       13                     B=ZERO.
42      141                     BEX0 B=B.                       GET BUF ST REG
43      101                     B=B.
44      627                     IF MST STEP ELSE SKIP. INPUT BUF EMPTY?
45      657                     JUMP.                   EXIT
46      607                      STEP.
47     6215                     A3=A3+1.                        INCR TM PAR
50     3707                     IF ABT SKIP ELSE STEP. 2 MSEC TMOUT?
51        3
52     1036                     GOTO INBL.              NO
53      657                     JUMP.                   YES,ERROR COND
                        *               7 MSEC WAIT SUB.
                         WT7MS.
54     7613                     B=248.
55      105                     A1=B.
56     1511                     A2=0.
                         INLP1.
57     4211                     A2=A2+1.
60     3707                     IF ABT SKIP ELSE STEP.
61        3
62     1376                     GOTO INLP1.
63     1511                     A2=0.
64     2205                     A1=A1+1.
65     3707                     IF ABT SKIP ELSE STEP.
66        3
67     1376                     GOTO INLP1.
70      657                     JUMP.
                        *       SUBROUTINES LPC,LKFR,LKTOP,REBLDR,WRMAIL,
                        *          SUBROUTINE TO PUT LPC IN A1
                         LPC.
                        *               ELIMINATE HANGS
71        4                     DEV1=0.
72     7733                     B=253.
73      121                     OUT0=B.
74     2305                     A1=A1.
75     2345                     BEX1 A1=A1.
76      101                      B=B.
77     3627                     IF ABT STEP ELSE SKIP.
100       3
101    2176                     GOTO LPCINIT.
102    7753                     B=254.
103     121                     OUT0=B.
104    7773                     B=255.
105     131                     OUT2=B.
106     607                     STEP.
                         LPCINIT.
107    1521                     OUT0=0.
110    1505                     A1=0.
                         LPCILP.
```

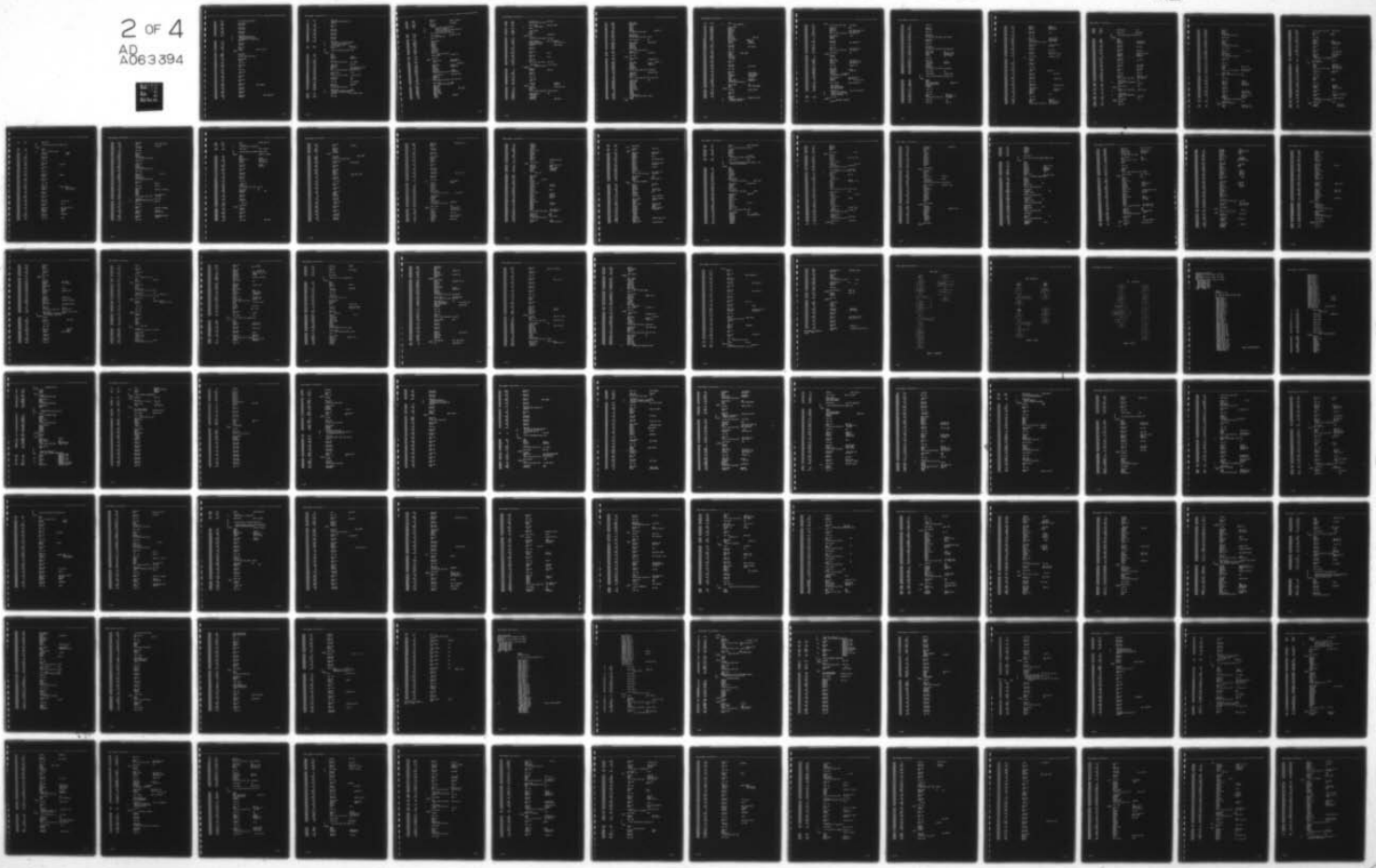
```
111     2305                    A1=A1.                      GET WD
112     2345                    BEX1 A1=A1.
113     2505                    A1=A1 XOR B.                XOR
114      101                    B=B.                        SET COND F/FS
115     3707                    IF ABT SKIP ELSE STEP.      STOP IF EOP
116        3
117     2236                    GOTO LPCILP.
120      657                    JUMP.
                        *
                        *        PAGE SET, WORD SET,
                        *        READ, WRITE MEMORY SUBROUTINES
                         PG.                                PAGE SET SUB
121      125                    OUT1=B.                     PAGE IN B REG
122      657                    JUMP.                       RETURN
                         WD.                                WORD SET SUB
123      121                    OUT0=B.                     WORD LOC IN B
124      657                    JUMP.                       RETURN
                         RD.                                READ FR MEM SUB
125     2305                    A1=A1.                      PROVIDE 10 CLOCKS
126     2345                    BEX1 A1=A1.                 RD INTO B REG
127      657                    JUMP.                       RETURN
                         WR.                                WRITE FR MEM SUB
130      131                    OUT2=B.                     FROM B
131      657                    JUMP.                       RETURN
                        *
                        *        BLAST TRANSFER SUBROUTINE
                         BLAST.
132     5513                    B=COUNT.                    SET CTR
                         AGAIN.
133        1                    B=B + 1.
134     3707                    IF ABT SKIP ELSE STEP.      TEST CTR
135        3
136     2676                    GOTO AGAIN.                    NO
137      657                    JUMP.                       YES, RETURN
                        *
                         INIT.
140      335                    OUT3 AMPCR=AMPCR.
141      335                    OUT3 AMPCR=AMPCR.           ACCESS NCU MEM
142        3
143     1306                    CALL WT7MS.                 GIVE NCU TM
144        3
145     1306                    CALL WT7MS.
146      104                    DEV1=4.                     INIT CRT
147        4                    DEV1=0.
150     1521                    OUT0=0.
151      607                    STEP.
152     3004                    DEV1=96.
153       33                    B=MAIL.
154        3
155     2426                    CALL PG.
156       13                    B=RDA.
157        3
160     2466                    CALL WD.
161      113                    B=VRDA.
162        3
163     2606                    CALL WR.
164       53                    B=VWRA.
165        3
166     2606                    CALL WR.
167       53                    B=VWTA.
```

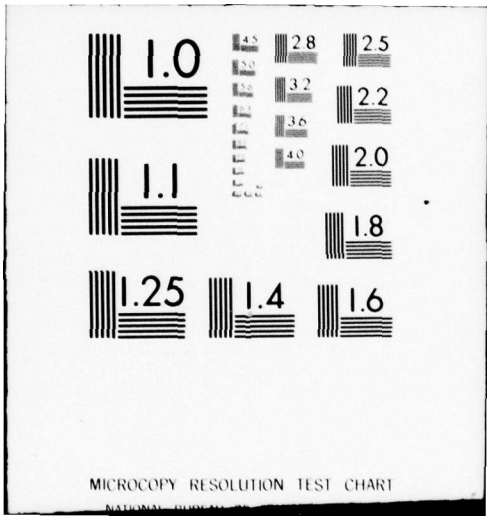
```
170       3
171    2606                    CALL WR.
172      13                    B=VINCU.
173       3
174    2606                    CALL WR.
175    4013                    B=VICIE.
176       3
177    2606                    CALL WR.
200      13                    B=VAKS.
201       3
202    2606                    CALL WR.
203    7773                    B=255.
204     121                    OUT0=B.
205       3
206    2606                    CALL WR.
207    1525                    OUT1=0.
210     121                     OUT0=B.
211       3
212    2606                    CALL WR.
213    1521                    OUT0=0.
214     607                    STEP.
                        *       LOAD WORKPAGE
215       4                    DEV1=0.                    CIE MEM
216      13                    B=WKPG.
217       3
220    2426                    CALL PG.
221      13                    B=ALT1.
222       3
223    2466                    CALL WD.
224      33                    B=VALT1.
225       3
226    2606                    CALL WR.
227      73                    B=VALT0.
230       3
231    2606                    CALL WR.
232    7773                    B=255.                     LOC 2-43
233     105                    A1=B.                      =0
234    1253                    B=42.
235    2605                    A1=A1 - B.
                        *       A1=COUNTER
                      INRP1.
236      13                    B=ZERO.
237       3
240    2606                    CALL WR.
241    2205                    A1=A1 + 1.
242    3707                    IF ABT SKIP ELSE STEP.
243       3
244    4756                    GOTO INRP1.
245    1313                    B=IQMAX.
246     121                    OUT0=B.
247     213                    B=VIQMAX.
250       3
251    2606                    CALL WR.
252      13                    B=VIQNOW.
253       3
254    2606                    CALL WR.
255      73                    B=VIQTOP.
256       3
257    2606                    CALL WR.
260      73                    B=VIQFR.
```

```
261       3
262    2606                    CALL WR.
263      33                    B=VOQMAX.
264       3
265    2606                    CALL WR.
266      13                    B=VOQNOW.
267       3
270    2606                    CALL WR.
271     273                    B=VOQTOP.
272       3
273    2606                    CALL WR.
274      13                    B=VOQFR.
275       3
276    2606                    CALL WR.
277      13                     B=ZERO.
300       3
301    2606                    CALL WR.
302       3
303    2606                    CALL WR.
304    1553                    B=DFFWT.
305     121                    OUT0=B.
306     313                    B=VDFFWT.                  LOC 54
307       3
310    2606                    CALL WR.
311    2713                    B=92.                      LOC 55-146
312    2605                    A1=A1 - B.                 =0
                     INRP3.
313      13                    B=ZERO.
314       3
315    2606                    CALL WR.
316    2205                    A1=A1 + 1.
317    3707                    IF ABT SKIP ELSE STEP.
320       3
321    6276                    GOTO INRP3.
322    1613                    B=BEGWD.
323     121                    OUT0=B.
324    1531                    OUT2=0.                    BEG WD NOT INIT SET
                     *        1 NODE ON EACH LOOP
                     *        WILL HAVE ITS BEGWD INITIALLY ON
                     *        TO GENERATE THE 1ST WT
                     *          CRT NODE USES LOCS. 149,150,151
325    4533                    B=OLID.
326       3
327    2466                    CALL WD.
330     113                    B=VOLID.
331       3
332    2606                    CALL WR.
333     133                    B=VPDDLID.
334       3
335    2606                    CALL WR.
336      33                    B=VADDLID.
337       3
340    2606                    CALL WR.
341    3013                    B=96.                      LOC 152-247
342    2605                    A1=A1 - B.                 =0
                     INRP4.
343      13                    B=ZERO.
344       3
345    2606                    CALL WR.
346    2205                    A1=A1 + 1.
```

AD-A063 394 BURROUGHS CORP PAOLI PA FEDERAL AND SPECIAL SYSTEMS GROUP F/G 17/2
EXPLORATORY SYSTEMS CONTROL MODEL (ESM). SOFTWARE MAINTENANCE M--ETC(U)
APR 77 DCA100-75-C-0054
UNCLASSIFIED 66143-3-BK-2 SBIE-AD-E100 138 NL

2 OF 4
AD
A063394




1.0
1.1
1.25
1.4
1.6
1.8
2.0
2.2
2.5
2.8
3.2
3.6
4.0
MICROCOPY RESOLUTION TEST CHART

```
347     3707                    IF ABT SKIP ELSE STEP.
350        3
351     7076                    GOTO INRP4.
352     7733                    B=LOOPNO.
353        3
354     2466                    CALL WD.
355      113                    B=VLOOPNO.
356        3
357     2606                    CALL WR.
360      273                    B=VSYSNO.
361        3
362     2606                    CALL WR.
                        *        LOAD CONVERSION PG
                        *        SPECIAL LIDS MAY ALSO
                        *        BE LOADED AT A LATER TIME
363       33                    B=TABL.
364        3
365     2426                    CALL PG.
366       13                    B=ZERO.
367        3
370     2466                    CALL WD.
371      105                    A1=B.
372       13                    B=ZERO.                 SND TO FAD 0
                      INRP5.
373        3
374     2606                    CALL WR.
375     2205                    A1=A1 + 1.
376     3707                    IF ABT SKIP ELSE STEP.
377        3
400     7676                    GOTO INRP5.
401       33                    B=ONE.
402        3
403     2466                    CALL WD.
404        3
405     2606                    CALL WR.
406      113                    B=4.
407        3
410     2466                    CALL WD.
411        3
412     2606                     CALL WR.
413       53                    B=2.
414        3
415     2606                    CALL WR.
416      213                    B=8.
417        3
420     2466                    CALL WD.
421       73                    B=3.
422        3
423     2606                    CALL WR.
424     3773                    B=127.                  CRT BRDCST
425        3
426     2466                    CALL WD.
427       53                    B=VWTA.
430        3
431     2606                    CALL WR.
432     7753                    B=254.
433        3
434     2466                    CALL WD.                        SYST BROADCST
435       53                    B=VWTA.
436        3
```

```
437     2606                CALL WR.
                    *        LOAD ACK/NAK BUILDER PG
440       53                B=BLDR.
441        3
442     2426                CALL PG.
443       73                B=3.
444        3
445     2466                CALL WD.
446      153                B=VAKCUR.
447        3
450     2606                CALL WR.
451      153                B=VAKFR.
452        3
453     2606                CALL WR.
454       13                B=VAKS.
455        3
456     2606                CALL WR.
                    *        DATA MEM IS NOW INITIALIZED
                    *        SET NCU EXT TO FORCE IT
                    *        TO THE READ STATE
457     5607                IF LC2 STEP.            RESET LC2
460       20                DEV0=1.                   INT NCU
                    *
                    *        *** #1 BACKGROUND MODULE ***
                    *
                     BACK.
461      607                STEP.
462      607                STEP.
463        4                DEV1=0.                   CLEAR
464       13                B=WKPG.                   WORKPAGE
465        3
466     2426                CALL PG.
467     7627                IF EXT STEP ELSE SKIP.    INT PRES:
470       43
471     4216                GOTO CONT.               EXIT #2
472       13                B=ZERO.
473      141                BEXO B=B.                 GET STATUS BUF REG
474      101                B=B.                      SET COND F/FS
475     2627                IF LST STEP ELSE SKIP.   OUT BUF FULL?
476      163
477     1776                GOTO EXXCIE.               YES
500      101                B=B:
501      707                IF MST SKIP ELSE STEP.    IN BUF EMPTY?
502       43
503     1336                GOTO WTTM.                NO
504     1333                B=IQNOW.                  YES
505        3
506     2466                CALL WD.                  GET CURRENT
507        3
510     2526                CALL RD.                  IQ SIZE
511      401                B=0 EQV B.                =0?
512     3627                IF ABT STEP ELSE SKIP.
513       43
514     1336                GOTO WTTM.                YES
                    *        NO-BLAST TRANSFER CONTENTS ON
                    *        PG IQTOP TO INPUT BUFFER
515     1353                B=IQTOP.                  GET IQTOP VALUE
516        3
517     2466                CALL WD.
520        3
```

```
521     2526                    CALL RD.
522      105                    A1=B.                    SAVE A1=IQTOP
523        3
524     2426                    CALL PG.                 PG IQTOP
525     1521                    OUT0=0.
526      607                      STEP.
                        *             CIE TO CRT SND ROUTINE
                        *             A1=PG #, A2=WD #
                        *             IF LC2 ON-CONT AS BEFORE NCU INT
                        *             IF LC2 OFF-SND ENQ
527     5627                    IF LC2 STEP ELSE SKIP. LC2 ON?
530       23
531     5136                    GOTO MIDMES.             YES,MID OF MSG
                        *             NO, SND ENQ
532     2315                    A3=A1.
533        3
534     1306                    CALL WT7MS.
535     6305                    A1=A3.
536     2325                    OUT1=A1.
537     1521                    OUT0=0.
540      133                    B=ENQ.
541      131                    OUT2=B.
542     1521                      OUT0=0.
543     4104                    DEV1=132.
544     4004                    DEV1=128.
545      221                    OUT0=1.
                        *             WAIT FOR AN ACK
546     6355                    BEX3 A3=A3.              LD STRT TM
547        3
550     2606                    CALL WR.
                        LKER1.
551     6355                     BEX3 A3=A3.             GET CLOCK
552      115                     A3=B.                   A3=CURCLK TM
553        3
554     2526                    CALL RD.                         B=STRT TM
555     6715                    A3=A3-B-1.               A3=DFF
556      373                    B=15.                    B=MAX DFF
557     6215                     A3=A3+1.
560     6215                    A3=A3+1.
561     6715                    A3=A3-B-1.               A3=DFF
562     1627                    IF AOV STEP ELSE SKIP.   A3>MAXDFF?
563       43
564     2076                     GOTO STOTCK.            YES,ERR COND
565       13                    B=ZERO.
566      141                    BEX0 B=B.
567      101                    B=B.
570     2707                    IF LST SKIP ELSE STEP.   OUT BUF FULL?
571       23
572     3236                    GOTO LKER1.              NO
                        *             CK IF ACK RECEIVED
573     4004                    DEV1=128.
574     2325                    OUT1=A1.
575      221                    OUT0=1.                          REC CHAR
576     4044                    DEV1=130.
577     4064                    DEV1=131.
600     4004                    DEV1=128.
601     2345                    BEX1 A1=A1.
602      607                    STEP.
603      115                    A3=B.                    A3=CHAR
604      153                    B=ACK.
```

```
605     6415                    A3=A3 EQV B.            ACK REC?
606     3707                    IF ABT SKIP ELSE STEP.
607       43
610     2076                    GOTO STOTCK.            NO,TRY LATER
                        *           SEND PACKET
611     2315                    A3=A1.
612        3
613     1306                     CALL WT7MS.
614     6305                    A1=A3.
615       53                    B=2.
616      111                    A2=B.                   A2=WD PTR
                         ACTIVLK.
617        4                     DEV1=0.
620     7707                    IF EXT SKIP ELSE STEP.  EXT ON?
621       23
622     5456                     GOTO CIECRT.           NO, SND PACKET
623      335                    OUT3 AMPCR=AMPCR.               YES, RESET EXT
624      335                    OUT3 AMPCR=AMPCR.
625       13                    B=WKPG.                         HOLD STATUS
626        3
627     2426                    CALL PG.
630     4633                    B=153.
631        3
632     2466                    CALL WD.
633     2301                    B=A1.                   PG #
634        3
635     2606                    CALL WR.
636     4301                    B=A2.                   WD #
637        3
640     2606                    CALL WR.
641      201                    B=1.
642     2207                    IF LST SET LC2 STEP.    SET LC2
643       43
644     4216                     GOTO CONT.             EXIT TO CONT
                        *           MIDDLE OF MSG
                         MIDMES.
645        4                    DEV1=0.
646       13                    B=WKPG.                 GET PG
647        3
650     2426                    CALL PG.
651     4633                    B=153.
652        3
653     2466                    CALL WD.
654        3
655     2526                     CALL RD.
656      105                    A1=B.
657        3
660     2526                    CALL RD.                        A1=PG #
661      111                      A2=B.                         A2=WD #
                         CIECRT.
662       13                    B=ZERO.                         CK ST BUF REG
663      141                    BEXO B=B.
664      101                    B=B.
665      707                    IF MST SKIP ELSE STEP.  IN BUF EMPTY?
666       23
667     4376                    GOTO ACTIVLK.           NO
670     4004                    DEV1=128.
671     2325                      OUT1=A1.
672     4321                    OUT0=A2.
673     4104                    DEV1=132.                       SND CHAR
```

```
674   4004                DEV1=128.
675   2345                BEX1 A1=A1.
676    131                OUT2=B.
677    607                STEP.
700    115                A3=B.
701     73                B=ETX.
702   4211                A2=A2+1.                          INCR WD #
703   3627                IF ABT STEP ELSE SKIP.
704     23
705   7536                GOTO SEOT.
706   6415                A3=A3 EQV B.
707   3707                IF ABT SKIP ELSE STEP. =ETX?
710     23
711   4376                GOTO ACTIVLK.             NO
712      3
713   1006                CALL LKINB.               YES,SND BCC
714   4004                DEV1=128.
715   2325                OUT1=A1.
716   4321                OUT0=A2.
717   4104                DEV1=132.
720   4004                DEV1=128.
                    *             LOOK FOR AN ACK
721   1521                OUT0=0.
722   6355                BEX3 A3=A3.               LD STRT TM
723      3
724   2606                CALL WR.
                  LKER2.
725   6355                BEX3 A3=A3.
726    115                A3=B.                     A3=CURCLK TM
727      3
730   2526                CALL RD.                          B=STRT TM
731   6715                A3=A3-B-1.                A3=DFF
732    373                B=15.                     B=MAX DFF
733   6215                A3=A3+1.
734   6215                A3=A3+1.
735   6715               A3=A3-B-1.
736   1627                IF AOV STEP ELSE SKIP.    A3>MAXDFF?
737     23
740   7536                GOTO SEOT.                YES,ERR COND
741     13                B=ZERO.
742    141                BEX0 B=B.
743    101                B=B.
744   2707                IF LST SKIP ELSE STEP.    OUT BUF FULL?
745     23
746   6536                GOTO LKER2.               NO
747   4004                DEV1=128.
750   2325                OUT1=A1.
751   1521                OUT0=0.
752   4044                DEV1=130.
753   4064                DEV1=131.
754   4004                DEV1=128.
755   4345                BEX1 A1=A1.
756    607                STEP.
757    115                A3=B.
760    153                B=ACK.
761   6415                A3=A3 EQV B.
762   3707                IF ABT SKIP ELSE STEP. =ACK?
763    607                STEP.
764    607                STEP.
                  SEOT.
```

```
 765    2315                 A3=A1.
                   *                YES, SEND EOT
 766       3
 767    1306                 CALL WT7MS.
 770    6305                 A1=A3.
 771    4004                 DEV1=128.
 772    2325                 OUT1=A1.
 773    1521                 OUT0=0.
 774    4113                 B=EOT.
 775     131                 OUT2=B.
 776    1521                 OUT0=0.
 777    4104                 DEV1=132.                      SND EOT
1000    4004                 DEV1=128.
1001    5607                 IF LC2 STEP.            RESET LC2
1002       4                 DEV1=0.                   CLEAR
1003      13                 B=WKPG.                   WORKPAGE
1004       3
1005    2426                 CALL PG.
1006    1333                 B=IQNOW.                  GET IQNOW
1007       3
1010    2466                 CALL WD.
1011       3
1012    2526                 CALL RD.
1013     105                 A1=B.           DECR IQNOW
1014      33                 B=ONE.
1015    2205                 A1=A1+1.
1016    2705                 A1=A1-B-1.
1017    1333                  B=IQNOW.
1020       3
1021    2466                 CALL WD.
1022    2301                 B=A1.
1023       3
1024    2606                 CALL WR.
1025    1353                 B=IQTOP.                  GET IQTOP
1026       3
1027    2466                 CALL WD.
1030       3
1031    2526                 CALL RD.
1032       1                 B=B + 1.                  INCR IQTOP
1033     105                 A1=B.                     A1=NEW IQTOP
1034     213                 B=VIQMAX.                  GET IQMAX
1035     111                 A2=B.                     A2=IQMAX
1036      73                 B=3.
1037    4101                 B=A2 + B.                 B=IQMAX+ 3
1040    2415                 A3=A1 EQV B.              IQTOP=B?
1041    3707                 IF ABT SKIP ELSE STEP.
1042      43
1043    1156                 GOTO WRIQT.               NO
1044      73                 B=3.                      YES, WRAPAROUND
1045     105                 A1=B.
                   WRIQT.
1046    1353                 B=IQTOP.                  WRITE IQTOP
1047       3
1050    2466                 CALL WD.
1051    2301                 B=A1.
1052       3
1053    2606                 CALL WR.
1054       4                 DEV1=0.                   ENABLE MAR INCR
                   *         LOOK FOR TIMEOUTS TO
                   *         GENERATE NEW WTS
```

```
                        WTTM.
1055    7627                    IF EXT STEP ELSE SKIP.    INT PRES!
1056      43
1057    4216                    GOTO CONT.                EXIT
1060      13                    B=ZERO.
1061     141                    BEXO B=B.                  GET STATUS BUF REG
1062     101                    B=B.                       SET COND F/FS
1063    2627                    IF LST STEP ELSE SKIP.    OUT BUF FULL?
1064     163
1065    1776                    GOTO EXXCIE.               YES
1066       4                    DEV1=0.
1067      13                    B=WKPG.
1070       3
1071    2426                    CALL PG.
1072    1613                    B=BEGWD.                   GET BEGIN WD
1073       3
1074    2466                    CALL WD.
1075       3
1076    2526                    CALL RD.
1077     101                    B=B.                       SET COND F/FS
1100    2707                    IF LST SKIP ELSE STEP.     REG WD ON?
1101      23
1102    1436                    GOTO BACK.                 NO
                        STOTCK.
1103       4                    DEV1=0.
1104      13                    B=WKPG.
1105       3
1106    2426                    CALL PG.
1107    6355                    BEX3 A3=A3.                GET CLK TM
1110     105                    A1=B.                      A1=CURCLK TIME
1111    1533                    B=LSTWT.                   GET LAST WT
1112       3
1113    2466                    CALL WD.                   RECEPT TM
1114       3
1115    2526                    CALL RD.
1116    2705                    A1=A1-B-1.                 A1=DFF
1117     313                    B=VDFFWT.                    GET MAX
1120    2205                    A1=A1+1.
1121    2705                    A1=A1-B-1.      A1>MAXDFF?
1122    1707                    IF AOV SKIP ELSE STEP.
1123      43
1124    3036                    GOTO PAKOUT.               ACK WAIT ROUT
1125      20                    DEV0=1.                    SOFT INT
1126      34                    DEV3=1.                           HRD INT NCU
1127       3
1130    1306                    CALL WT7MS.                WAIT FOR SYNCH
1131       3
1132    1306                     CALL WT7MS.
1133     335                    OUT3 AMPCR=AMPCR.
1134     335                    OUT3 AMPCR=AMPCR.
1135      63
1136    7356                    GOTO OUTQ.                   AS IF WT RECEIVED
                        *        LOOK AT OUTSTANDING
                        *        PACKET ON OUTPUT PAGE
                        *        WAITING FOR ACK
1137       3
1140    2426                    CALL PG.
                         PAKOUT.
                        *              MSG SENT TIMEOUTS
1141       4                    DEV1=0.
```

```
1142    13                  B=WKPG.
1143     3
1144  2426                  CALL PG.
1145  1433                  B=OQNOW.
1146     3
1147  2466                  CALL WD.
1150     3
1151  2526                  CALL RD.
1152   401                  B=0 EQV B.
1153  3627                  IF ABT STEP ELSE SKIP. PACK PRES?
1154    23
1155  1436                  GOTO BACK.
1156  1473                  B=OQFR.
1157     3
1160  2466                  CALL WD.
1161     3
1162  2526                  CALL RD.
1163   401                  B=0 EQV B.
1164  3627                  IF ABT STEP ELSE SKIP. ACK WAITING?
1165    23
1166  1436                  GOTO BACK.              NO
1167  6355                  BEX3 A3=A3.             GET CLK TIME
1170   105                  A1=B.                   A1=CURCLK TM
1171  6273                  B=203.                  GET TM SENT
1172     3
1173  2466                  CALL WD.
1174     3
1175  2526                  CALL RD.
1176  2705                  A1=A1-B-1.              A1=DFF
1177  1233                   B=VMAXCK.              GET MAX
1200  2205                  A1=A1+1.
1201  2205                  A1=A1+1.
1202  2705                  A1=A1-B-1.
1203  1707                  IF AOV SKIP ELSE STEP. A1>MAXDFF?
1204    23
1205  1436                  GOTO BACK.              NO
1206   123
1207  2036                  GOTO NNACK.             YES,NAK REC
                      *
                      *      *** #2 NODE CONTROLLER MODULE ***
                      *
                       CONT.
1210   607                  STEP.
1211   607                  STEP.
1212   335                  OUT3 AMPCR=AMPCR.                RESET EXT
1213   335                  OUT3 AMPCR=AMPCR.
1214  3004                  DEV1=96.
1215    13                  B=ZERO.
1216     3
1217  2426                   CALL PG.
1220     3
1221  2466                  CALL WD.
1222     3
1223  2526                  CALL RD.                GET D1
1224   101                  B=B.                    SET COND F/FS
1225  3707                  IF ABT SKIP ELSE STEP.   D1=255?
1226    43
1227  5456                  GOTO RS.                NO
1230     3
1231  2526                  CALL RD.                YES, WT
```

```
1232      111                 A2=B.                    A2=D2
1233     3004                 DEV1=96.                 ACCESS NCU
1234       33                 B=MAIL.                  MAILBOX PG
1235        3
1236     2426                 CALL PG.
1237       13                 B=ZERO.                  WD 0
1240        3
1241     2466                 CALL WD.
1242        3
1243     2526                 CALL RD.                 GET RD ADDR
1244      105                 A1=B.                    A1=RD ADDR
1245     4401                 B=A2 EQV B.              D2=RD ADDR?
1246     3627                 IF ABT STEP ELSE SKIP.
1247       63
1250     7356                 GOTO OUTQ.                YES, VALID WT
1251      113                 B=ICIE.                  WD ICIE
1252        3
1253     2466                 CALL WD.
1254     4013                 B=128.                   SET MSB
1255        3
1256     2606                 CALL WR.                 WRITE ICIE
1257       20                 DEV0=1.                  INT NCU - (READ)
1260       23
1261     1436                 GOTO BACK.               RETURN TO BACK
                    RS.
1262        4                 DEV1=0.
1263       13                 B=WKPG.
1264        3
1265     2426                 CALL PG.
1266     1373                 B=IQFR.
1267        3
1270     2466                 CALL WD.
1271        3
1272     2526                  CALL RD.
1273      115                 A3=B.                    A3=IQFR
1274        3
1275     2426                 CALL PG.                          PG IQFR
1276       13                 B=ZERO.
1277        3
1300     2466                 CALL WD.
1301     3004                 DEV1=96.                          ACCESS NCU
1302        3
1303     2426                 CALL PG.
1304        3
1305     2466                 CALL WD.
1306     2404                 DEV1=80.                          BLAST NCU-CIE
1307        3
1310     2646                 CALL BLAST.
1311       24                  DEV1=1.                          TERM XFER
1312        4                 DEV1=0.                           CLEAR
1313     6301                 B=A3.
1314      125                 OUT1=B.
1315       53                 B=2.                     WD 2
1316        3
1317     2466                 CALL WD.
1320        3
1321     2526                 CALL RD.                 GET D3
1322      161                 BS=B.                    ROTATE 1 RT
1323      101                 B=B.                     SET COND F/FS
1324     2707                 IF LST SKIP ELSE STEP.   R/S BIT ON?
```

```
1325      43
1326    6636                    GOTO INTRD.             NO
1327      63
1330    3616                    GOTO INTO.              YES,BRDCST
                        *
                        *        *** #3 NCU READ INT MODULE ***
                        *
                         INTRD.
1331     607                    STEP.
1332     607                    STEP.
1333    3004                    DEV1=96.                ACCESS NCU
1334      33                    B=MAIL.                 MAILBOX PG
1335       3
1336    2426                    CALL PG.
1337     113                    B=ICIE.                 WD ICIE
1340       3
1341    2466                    CALL WD.
1342    4013                    B=128.                  SET MSB
1343       3
1344    2606                    CALL WR.                WRITE INT-READ
1345       4                    DEV1=0.                 CLEAR
1346      13                    B=WKPG.                 WORKPAGE
1347       3
1350    2426                    CALL PG.
1351    1373                    B=IQFR.                 WD IQFR
1352       3
1353    2466                    CALL WD.
1354       3
1355    2526                    CALL RD.                GET IQFR
1356     105                    A1=B.                   A1=IQFR
1357       3
1360    2426                    CALL PG.                PG IQFR
1361      53                    B=2.                    WD 2
1362       3
1363    2466                    CALL WD.                GET D3
1364       3
1365    2526                    CALL RD.                B=D3
1366     101                    B=B.                    SET COND F/FS
1367    2707                    IF LST SKIP ELSE STEP.  ACK BIT ON?
1370      43
1371    7736                    GOTO CKFNK.             NO
                        *         YES, AN ACK RECEIVED
1372      20                    DEV0=1.                 INT NCU
1373     123
1374     416                    GOTO OUTAK.             YES
                         CKFNK.
1375     101                    B=B.
1376     707                    IF MST SKIP ELSE STEP.  NAK BIT ON?
                        *         NO
1377      63
1400     116                    GOTO CNWMD.
                        *         YES, A NAK RECEIVED
1401      20                    DEV0=1.                 INT NCU
1402     123
1403     416                    GOTO OUTAK.             YES
                         CNWMD.
1404      13                    B=ZERO.
1405       3
1406    2466                    CALL WD.
1407       3
```

```
1410    2526            CALL RD.
1411     115            A3=B.
1412    2533            B=IC1.
1413    6401            B=A3 EQV B.
1414    3707            IF ABT SKIP ELSE STEP.
1415      63
1416    3516            GOTO NACM.
1417       3
1420    2526            CALL RD.
1421     115            A3=B.
1422    5253            B=IC2.
1423    6401            B=A3 EQV B.
1424    3707            IF ABT SKIP ELSE STEP.
1425      63
1426    3516            GOTO NACM.
1427       3
1430    1626            CALL LPC.                       CK LPC
1431    2305            A1=A1.
1432    2345            REX1 A1=A1.
1433    2401            B=A1 EQV B.
1434    3707             IF ABT SKIP ELSE STEP.
1435      63
1436    3516            GOTO NACM.
1437      53            B=2.
1440       3
1441    2466            CALL WD.
1442       3
1443    2526            CALL RD.
1444     161            BS=B.                   SHIFT 2 RT
1445     161            BS=B.
1446     101            B=B.                    SET COND F/FS
1447    2707            IF LST SKIP ELSE STEP.  RD ADDR ON?
1450      63
1451    1756            GOTO TOKEN.             NO
                *       MODIFY READ ADDRESS -FAD-
1452     153            B=6.                    WD 6
1453       3
1454    2466            CALL WD.
1455       3
1456    2526            CALL RD.                GET D7
1457     111            A2=B.                    A2=D7
1460    3004            DEV1=96.                ACCESS NCU
1461      33            B=MAIL.                 MAILBOX PG
1462       3
1463    2426            CALL PG.
1464      13            B=ZERO.
1465       3
1466    2466            CALL WD.                RD ADDR WD
1467    4301            B=A2.                   B=NEW FAD=D7
1470       3
1471    2606            CALL WR.                WRITE NEW FAD
1472      20            DEV0=1.                 INT NCU
1473       4            DEV1=0.                 CLEAR
                *         DONT WRITE TO EXEDEVICE
1474      23
1475    1436            GOTO BACK.              EXIT
                *       MODIFY WT ADDRESS
                 TOKEN.
1476     161            BS=B.                   ROTATE 1 RT
1477     101            B=B.                    SET COND F/FS
```

```
1500    2707                IF LST SKIP ELSE STEP.   WT MOD ON?
1501      63
1502    2576                GOTO PID.                  NO
1503     153                B=6.                    GET D7
1504       3
1505    2466                CALL WD.
1506       3
1507    2526                 CALL RD.
1510     111                A2=B.                   A2=D7
1511    3004                DEV1=96.                   ACCESS NCU
1512      33                B=MAIL.                    MAILBOX PG
1513       3
1514    2426                CALL PG.
1515      53                B=2.                       WTA WD 2
1516       3
1517    2466                CALL WD.
1520    4301                B=A2.                      B=D7=NEW WTA
1521       3
1522    2606                CALL WR.                   WRT NEW WTA
1523      20                DEV0=1.                    INT NCU
1524       4                DEV1=0.                    CLEAR
                    *         DONT WRITE TO EXEDEVICE
1525      23
1526    1436                GOTO BACK.                 EXIT
                    *       MOD. CONV. PG.
                     PID.
1527      20                DEV0=1.                    INT NCU
1530     161                BS=B.                      ROTATE 1 RT
1531     101                B=B.                       SET COND F/FS
1532    2707                IF LST SKIP ELSE STEP.     CONV BIT ON?
1533     123
1534    5516                GOTO INQ.                  NO, EXIT
1535     153                 B=6.                    GET D7
1536       3
1537    2466                CALL WD.
1540       3
1541    2526                CALL RD.
1542     111                A2=B.                   A2=D7
1543     173                B=7.                       WD 7
1544       3
1545    2466                CALL WD.
1546       3
1547    2526                CALL RD.                   GET D8
1550     115                A3=B.                      A3=D8
1551      33                B=TABL.                    CONV TABL PG
1552       3
1553    2426                CALL PG.
1554    4301                B=A2.                      WD D7
1555       3
1556    2466                CALL WD.                   LID TO BE CHANGED
1557    6301                B=A3.                      B=D8.
1560       3
1561    2606                CALL WR.                    WRITE NEW FAD
                    *         DONT WRITE TO EXODEVICE
1562      23
1563    1436                GOTO BACK.                 EXIT
                     NACM.
1564       4                DEV1=0.                          NOT CONT
1565      20                DEV0=1.                          INT NCU-RD
1566     123
```

```
1567    5516                    GOTO INQ.
                        *
                        *        *** #4 NCU WRITEO INT MODULE ***
                        *
                         INTO.
1570     607                    STEP.
1571     607                    STEP.
                        *                 GET WRITE ADDR
1572       4                    DEV1=0.                          CLEAR
1573      13                    B=WKPG.                          WKPG
1574       3
1575    2426                    CALL PG.
1576    1373                    B=IQFR.
1577       3
1600    2466                    CALL WD.
1601       3
1602    2526                    CALL RD.
1603     105                    A1=B.                    A1=IQFR
1604       3
1605    2426                    CALL PG.
1606     113                    B=4.
1607       3
1610    2466                    CALL WD.
1611       3
1612    2526                    CALL RD.
1613     115                    A3=B.                    A3=D5
1614      33                    B=TABL.
1615       3
1616    2426                    CALL PG.
1617    6301                    B=A3.
1620       3
1621    2466                    CALL WD.
1622       3
1623    2526                    CALL RD.
1624     115                    A3=B.                    A3=WRT ADDR
1625    3004                     DEV1=96.                        ACCESS NCU
1626      33                    B=MAIL.                          PG 1 MAILBOX
1627       3
1630    2426                    CALL PG.
1631      33                    B=WRA.
1632       3
1633    2466                    CALL WD.
1634    6301                    B=A3.
1635       3
1636    2606                    CALL WR.
1637     113                    B=ICIE.                    CIE INT WD
1640       3
1641    2466                    CALL WD.                   WD #4
1642      33                    B=ONE.
1643       3
1644    2606                    CALL WR.                   SET ICIE=1 WRTO
1645      20                    DEVO=1.                    INT NCU
1646       4                    DEV1=0.                    CLEAR
1647      13                    B=WKPG.                    PG 3
1650       3
1651    2426                    CALL PG.                   WORKPAGE
1652    1373                    B=IQFR.
1653       3
1654    2466                    CALL WD.                   IQFR
1655       3
```

```
1656    2526                CALL RD.
1657     105                A1=B.                    SAVE IQFR IN A1
1660       3
1661    2426                CALL PG.                 PG IQFR
1662      13                 B=ZERO.
1663       3
1664    2466                CALL WD.
1665       3
1666    2526                CALL RD.
1667     115                A3=B.
1670    2533                B=IC1.
1671    6401                B=A3 EQV B.
1672    3707                 IF ABT SKIP ELSE STEP.
1673     123
1674    5516                GOTO INQ.
1675       3
1676    2526                 CALL RD.
1677     115                A3=B.
1700    5253                B=IC2.
1701    6401                B=A3 EQV B.
1702    3707                IF ABT SKIP ELSE STEP.
1703     123
1704    5516                GOTO INQ.
1705       3
1706    1626                CALL LPC.                      CK LPC
1707    2305                A1=A1.
1710    2345                BEX1 A1=A1.
1711    2401                B=A1 EQV B.
1712    3707                IF ABT SKIP ELSE STEP.
1713     123
1714    5516                GOTO INQ.
1715      53                B=2.                     WD #2
1716       3
1717    2466                CALL WD.                 GET D3
1720       3
1721    2526                CALL RD.
1722     161                BS=B.                    ROTATE 4 TIMES RT
1723     161                BS=B.
1724     161                BS=B.
1725     161                BS=B.
1726     101                B=B.                     SET COND F/FS
1727    2707                IF LST SKIP ELSE STEP.   LST ON?
1730     123
1731    5516                GOTO INQ.                NO, EXIT
                  *          CHANGE CONVERSION TABLE
1732     153                B=6.                     GET D7
1733       3
1734    2466                CALL WD.
1735       3
1736    2526                CALL RD.
1737     111                A2=B.                    A2=LID TO CHANGE
1740       3
1741    2526                CALL RD.                 GET D8
1742     115                A3=B.                    A3=NEW FAD
1743      33                B=TABL.
1744       3
1745    2426                CALL PG.                 CONVERSION TABLE
1746    4301                B=A2.                    WD=LID
1747       3
1750    2466                CALL WD.
```

```
1751    6301                    B=A3.                   WRITE NEW FAD
1752       3
1753    2606                    CALL WR.
                *                 DONT WRITE TO EXODEVICE
1754      23
1755    1436                    GOTO BACK.              EXIT TO BACK
                *
                *                *** #5 OUTPUT Q HANDLER MODULE ***
                *
                OUTQ.                                   OUTPUT Q MODULE
1756     607                    STEP.
1757     607                    STEP.
1760       4                    DEV1=0.                 CLEAR
1761    6355                    BEX3 A3=A3.             GET CLK TM
1762     105                    A1=B.                   A1=CLKTM
1763      13                    B=WKPG.                 PUT A1 INTO
1764       3
1765    2426                    CALL PG.                LSTWT
1766    1533                    B=LSTWT.                ON WKPG
1767       3
1770    2466                    CALL WD.
1771    2301                    B=A1.
1772       3
1773    2606                    CALL WR.
1774      53                    B=BLDR.
1775       3
1776    2426                    CALL PG.
1777     133                    B=AKS.
2000       3
2001    2466                    CALL WD.
2002       3
2003    2526                      CALL RD.
2004     105                    A1=B.
2005     401                    B=0 EQV B.
2006    3707                    IF ABT SKIP ELSE STEP.  AKS=0?
2007     103
2010     536                    GOTO MOVE.              NO
2011    3004                    DEV1=96.                        YES
2012      33                    B=MAIL.
2013       3
2014    2426                    CALL PG.
2015     133                    B=AKS.
2016       3
2017    2466                    CALL WD.
2020      13                    B=ZERO.
2021       3
2022    2606                      CALL WR.
2023     103
2024    3576                    GOTO PKT.
                MOVE.
2025    2205                    A1=A1+1.
2026     133                    B=AKS.
2027       3
2030    2466                    CALL WD.
2031    2301                    B=A1.
2032       3
2033    2606                    CALL WR.
2034     113                    B=4.
2035       3
2036    2466                    CALL WD.                        GET AKFR
```

```
2037      3
2040   2526                 CALL RD.
2041    105                 A1=B.                    A1=AKFR
2042      3
2043   2466                 CALL WD.
2044   7773                 B=255.
2045   2605                 A1=A1-B.
2046     13                 B=ZERO.
                      LRZE.
2047      3
2050   2606                 CALL WR.                          WRT ZEROS
2051   2205                 A1=A1+1.
2052   3707                 IF ABT SKIP ELSE STEP.
2053    103
2054   1176                 GOTO LRZE.
2055   7753                 B=254.                   WD 254=EOP
2056      3
2057   2466                 CALL WD.
2060   7773                 B=EOP.
2061      3
2062   2606                 CALL WR.
2063   1521                 OUT0=0.
2064    607                 STEP.
2065   3004                 DEV1=96.
2066     33                 B=MAIL.                  MOVE MAIL PARS
2067      3
2070   2426                 CALL PG.
2071     13                 B=ZERO.
2072      3
2073   2466                  CALL WD.
2074      3
2075   2526                 CALL RD.
2076    105                 A1=B.
2077      3
2100   2526                  CALL RD.
2101    111                 A2=B.
2102      3
2103   2526                  CALL RD.
2104    115                 A3=B.
2105      4                 DEV1=0.
2106     53                 B=BLDR.
2107      3
2110   2426                 CALL PG.
2111     13                 B=ZERO.
2112      3
2113   2466                  CALL WD.
2114   2301                  B=A1.
2115      3
2116   2606                 CALL WR.
2117   4301                 B=A2.
2120      3
2121   2606                 CALL WR.
2122   6301                 B=A3.
2123      3
2124   2606                  CALL WR.
2125     13                 B=VINCU.
2126      3
2127   2606                 CALL WR.
2130     13                 B=ZERO.
2131      3
```

```
2132    2466            CALL WD.                        BLDR-MAIL XFER
2133    3004            DEV1=96.
2134      33            B=ONE.
2135       3
2136    2426            CALL PG.
2137      13             B=ZERO.
2140       3
2141    2466            CALL WD.
2142    3204            DEV1=104.
2143       3
2144    2646            CALL BLAST.
2145       4            DEV1=0.
2146    1521            OUT0=0.
2147     607            STEP.
2150      53            B=BLDR.
2151       3
2152    2426            CALL PG.
2153      73            B=3.
2154       3
2155    2466            CALL WD.
2156     153            B=VAKCUR.
2157       3
2160    2606            CALL WR.
2161     153             B=VAKFR.                       INIT BLDR PG
2162       3
2163    2606            CALL WR.
2164      13            B=VAKS.
2165       3
2166    2606            CALL WR.
                PKT.                                    GET OQNOW
2167       4            DEV1=0.                         CLEAR
2170      13            B=WKPG.
2171     125            OUT1=B.
2172    1473            B=OQFR.
2173     121            OUT0=B.
2174    2305            A1=A1.
2175    2345            BEX1 A1=A1.
2176     401            B=0 EQV B.
2177    3707             IF ABT SKIP ELSE STEP.         PACK SENT?
2200     103
2201    4256            GOTO WORD2.
2202    1433            B=OQNOW.
2203     121            OUT0=B.
2204    2305            A1=A1.
2205    2345             BEX1 A1=A1.
2206     401            B=0 EQV B.                      OQNOW=0?
2207    3707            IF ABT SKIP ELSE STEP.
2210     103
2211    5076            GOTO TOPQ.                      NO
                WORD2.                                   YES,Q EMPTY
2212    3004            DEV1=96.                        ACCESS NCU
2213      53            B=2.                            PG 2-OUTPUT PG
2214     125            OUT1=B.
2215    7733            B=253.                          WD 253
2216     121            OUT0=B.
2217      13            B=ZERO.                          =0 TO INDICATE
2220     131            OUT2=B.                         EMPTY PAGE
2221     607            STEP.
2222     131            OUT2=B.                         WD 254=0
2223     607            STEP.
```

```
2224      33                B=MAIL.
2225     125                OUT1=B.
2226      53                 B=WTA.
2227     121                OUT0=B.
2230    2305                A1=A1.
2231    2345                BEX1 A1=A1.
2232     105                A1=B.
2233      33                B=WRA.
2234     121                OUT0=B.
2235    2301                B=A1.
2236     131                OUT2=B.
2237     607                STEP.
2240       4                DEV1=0.                  RETURN CIE MEM
2241     163
2242    1156                GOTO INT1-2.             EXIT
                    TOPQ.
2243      13                B=WKPG.                  VALID TOP OF Q
2244     125                OUT1=B.                 WKPG
2245     273                B=VOQTOP.                 GET OQTOP
2246     111                A2=B.                    A2=OQTOP
2247    4301                B=A2.                    PG OQTOP
2250     125                OUT1=B.
                    *               SET LPC
2251       3
2252    1626                CALL LPC.
2253    2331                OUT2=A1.
2254     607                STEP.
2255     113                B=4.            GET D5
2256     121                OUT0=B.
2257    2305                A1=A1.
2260    2345                 BEX1 A1=A1.
2261     105                A1=B.                    A1=D5
2262      33                B=TABL.                  PG TABL
2263     125                OUT1=B.
2264    2301                B=A1.
2265     121                OUT0=B.                 WD D5
2266    2305                A1=A1.
2267    2345                BEX1 A1=A1.
2270     115                A3=B.                    A3=FAD
2271    4301                B=A2.                    GET D3
2272     125                OUT1=B.                 PG OQTOP
2273      53                B=2.                     WD 2
2274     121                OUT0=B.
2275    2305                A1=A1.
2276    2345                BEX1 A1=A1.
2277     161                BS=B.                    SHIFT RT
2300     161                BS=B.                    5 TMS
2301     161                BS=B.
2302     161                BS=B.
2303     161                BS=B.
2304     101                B=B.                     SET COND F/FS
2305    2707                IF LST SKIP ELSE STEP.   ALT ROUTE?
2306     103
2307    6456                GOTO NORM.               NO
2310      33                B=VALT1.                YES
2311    6415                A3=A3 EQV B.             ALT1=FAD?
2312    3627                IF ABT STEP ELSE SKIP.
2313     103
2314    6416                GOTO DFFF.               YES
2315     115                A3=B.                    NO,SET FAD=ALT1
```

```
2316     103
2317    6456                    GOTO NORM.
                          DFFF.
2320      73                    B=VALTO.                 GET ALTO
2321     115                    A3=B.
                          NORM.
2322    3004                    DEV1=96.                 ACCESS NCU
2323      33                    B=MAIL.                  MAIL PG
2324     125                    OUT1=B.
2325      33                    B=ONE.                   WD 1
2326     121                    OUT0=B.
2327    6301                    B=A3.                    SET WRITE ADDR
2330     131                    OUT2=B.
2331     607                    STEP.
2332       4                    DEV1=0.                  RTN TO CIE MEM
2333    4301                    B=A2.                    PG OQTOP
2334     125                    OUT1=B.
2335    7733                    B=253.                   WD 253
2336     121                    OUT0=B.
2337    2305                    A1=A1.
2340    2345                    BEX1 A1=A1.
2341     101                    B=B.                     SET COND F/FS
2342    3627                    IF ABT STEP ELSE SKIP.   253=EOP?
2343     103
2344    7216                    GOTO MVBL.               YES
2345    7773                    B=EOP.                   NO
2346     131                    OUT2=B.                 SET 254=EOP
2347     607                    STEP.
                     *            DO BLAST TRANSFER
                          MVBL.
2350    4301                    B=A2.                    PG OQTOP
2351     125                    OUT1=B.                 WD 0
2352      13                    B=ZERO.
2353     121                    OUT0=B.
2354    3004                    DEV1=96.                 ACCESS NCU
2355      53                    B=2.                     PG 2 - NCU
2356     125                    OUT1=B.                 WD 0
2357      13                    B=ZERO.
2360     121                    OUT0=B.
2361    3204                    DEV1=104.                BLAST CIE-NCU
2362       3
2363    2646                    CALL BLAST.              BLAST TRANSFER
2364       4                    DEV1=0.                  CLEAR
2365    1521                    OUT0=0.
2366     607                    STEP.
2367    6355                    BEX3 A3=A3.              GET CLK TM
2370     105                    A1=B.                    A1=CLK TM
2371      13                    B=WKPG.                  WKPG
2372     125                    OUT1=B.                 SET OQ TM SENT
2373    6273                    B=203.                   INDICATOR
2374     121                    OUT0=B.
2375    2301                    B=A1.
2376     131                    OUT2=B.
2377     607                    STEP.
2400    3173                    B=103.
2401     121                    OUT0=B.
2402    4004                    DEV1=128.                DISABLE MAR INCR
2403    2305                    A1=A1.
2404    2345                    BEX1 A1=A1.
2405       1                    B=B + 1.                 INCR OQ #TMS
```

```
2406     131                    OUT2=B.                  SENT INDICATOR
2407     607                    STEP.
                        *              SET PACKET WAIT FOR ACK
2410    1473                    B=OQFR.
2411     121                    OUT0=B.
2412      33                    B=ONE.
2413     131                    OUT2=B.
2414     607                    STEP.
2415       4                    DEV1=0.                    CLEAR
                        *        CONTINUE FOR BOTH TYPES OF NODE
2416     163
2417    1156                    GOTO INT1-2.             EXIT
                        *,
                        *         *** #6 OUTSTANDING ACK HAND MODULE  ***
                        *          NO ACKS ON BROADCASTS
                        *
                         OUTAK.
2420     607                    STEP.
2421     607                    STEP.
2422       4                    DEV1=0.
2423      13                    B=WKPG.
2424     125                    OUT1=B.
2425    1433                    B=OQNOW.
2426     121                    OUT0=B.
2427    2305                    A1=A1.
2430    2345                    BEX1 A1=A1.
2431     401                    B=0 EQV B.
2432    3627                     IF ABT STEP ELSE SKIP.        PACK PRES?
2433      23
2434    1436                    GOTO BACK.               NO,JUNK REC
2435    1473                    B=OQFR.
2436     121                    OUT0=B.
2437    2305                    A1=A1.
2440    2345                    BEX1 A1=A1.
2441     401                    B=0 EQV B.
2442    3627                     IF ABT STEP ELSE SKIP.        WAIT?
2443      23
2444    1436                    GOTO BACK.               JUNK REC
2445    1373                    B=IQFR.
2446     121                    OUT0=B.
2447    2305                    A1=A1.
2450    2345                    BEX1 A1=A1.
2451     115                    A3=B.
2452     125                    OUT1=B.
2453      53                    B=2.                     GET D3
2454     121                    OUT0=B.
2455    2305                    A1=A1.
2456    2345                    BEX1 A1=A1.
2457     101                    B=B.
2460    2707                    IF LST SKIP ELSE STEP. ACK?
2461     123
2462    2036                    GOTO NNACK.              NO
2463      13                    B=WKPG.                          YES
2464     125                    OUT1=B.                  SET OQNOW,OQFR=0
2465    1433                    B=OQNOW.
2466     121                    OUT0=B.
2467      13                    B=ZERO.
2470     131                     OUT2=B.
2471     607                     STEP.
2472    1473                    B=OQFR.
```

```
2473     121                OUT0=B.
2474      13                B=ZERO.
2475     131                OUT2=B.
2476     607                STEP.
2477      23
2500    1436                GOTO BACK.                      EXIT
                    NNACK.
2501      13                B=WKPG.
2502     125                OUT1=B.
2503    3173                B=103.                  GET #TMS SENT
2504     121                OUT0=B.
2505    2305                A1=A1.
2506    2345                  REX1 A1=A1.
2507     105                A1=B.
2510      53                B=VMAXTR.                       GET MAX
2511    2405                A1=A1 EQV B.            #TMS=MAX?
2512    3707                IF ABT SKIP ELSE STEP.
2513     123
2514    5336                GOTO RRLNKS.            NO RESEND
                    *               YES ALT ROUTE ROUTINE HERE
2515     273                B=VOQTOP.
2516     125                OUT1=B.
2517      53                B=2.                    GET D3
2520     121                OUT0=B.
2521    2305                 A1=A1.
2522    2345                 REX1 A1=A1.
2523     105                A1=B.                   A1=D3
2524     161                BS=B.                   ROTATE 5 TMS
2525     161                BS=B.
2526     161                BS=B.
2527     161                BS=B.
2530     161                BS=B.
2531     101                B=B.
2532    2627                IF LST STEP ELSE SKIP.  ALTRT USED?
2533     123
2534    4136                GOTO PSLLD.             YES
2535     113                B=4.
2536     121                OUT0=B.                         GET D5
2537    2305                A1=A1.
2540    2345                 REX1 A1=A1.
2541     111                 A2=B.                  A2=D5
2542      33                B=TABL.
2543     125                OUT1=B.
2544    4301                B=A2.
2545     121                OUT0=B.
2546    2305                A1=A1.
2547    2345                 REX1 A1=A1.
2550     111                 A2=B.                  A2=WRT ADDR
2551      33                B=VALT1.
2552    4401                B=A2 EQV B.             A2=VALT1?
2553    3627                IF ABT STEP ELSE SKIP.
2554     123
2555    3476                GOTO ALTROK.
2556      73                B=VALT0.
2557    4401                B=A2 EQV B.             A2=VALT0
2560    3707                IF ABT SKIP ELSE STEP.
2561     123
2562    4136                GOTO PSLLD.             NO ALTRT
                    ALTROK.
2563    1013                B=32.
```

```
2564    2105                A1=A1+B.                        A1=NEW D3
2565     273                B=VOQTOP.
2566     125                OUT1=B.
2567      53                B=2.
2570     121                OUT0=B.
2571    2301                 B=A1.
2572     131                OUT2=B.
2573     607                STEP.
2574      13                B=WKPG.
2575     125                OUT1=B.
2576    3173                B=103.
2577     121                OUT0=B.
2600      13                B=ZERO.
2601     131                OUT2=B.
2602     607                STEP.
2603     123
2604    5336                GOTO RRLNKS.
                    PSLLD.
2605     273                B=VOQTOP.
2606     125                OUT1=B.
2607     113                B=4.
2610     121                OUT0=B.
2611    2305                A1=A1.                  GET D5
2612    2345                BEX1 A1=A1.
2613     105                A1=B.                   A1=D5
2614      33                 B=VADDLID.
2615    2401                B=A1 EQV B.
2616    3627                IF ABT STEP ELSE SKIP.  D5=VADDLID?
2617     123
2620    4776                GOTO KLLPAC.            YES,KILL PACK
2621     113                B=4.
2622     121                OUT0=B.
2623      33                B=VADDLID.
2624     131                OUT2=B.
2625     607                STEP.
2626      13                 B=WKPG.
2627     125                OUT1=B.
2630    3173                B=103.
2631     121                OUT0=B.
2632      13                B=ZERO.
2633     131                OUT2=B.
2634     607                STEP.
2635     123
2636    5336                GOTO RRLNKS.
                    KLLPAC.
2637      13                B=WKPG.
2640     125                OUT1=B.
2641    1433                 B=OQNOW.                       DESTROY PACK
2642     121                OUT0=B.
2643      13                B=ZERO.
2644     131                OUT2=B.
2645     607                STEP.
2646    1473                B=OQFR.
2647     121                 OUT0=B.
2650      13                B=ZERO.
2651     131                 OUT2=B.
2652     607                 STEP.
2653      23
2654    1436                GOTO BACK.
                    RRLNKS.
```

```
2655    1473                    B=OQFR.
2656     121                     OUT0=B.
2657      13                    B=ZERO.
2660     131                    OUT2=B.
2661     607                     STEP.
2662      23
2663    1436                    GOTO BACK.
                        *
                        *       *** #7 CIE TO INPUT QUEUE HANDLER ***
                        *
                     INQ.
2664     607                    STEP.
2665     607                    STEP.
2666       4                    DEV1=0.
2667    1505                    A1=0.                       INIT LPC WD
2670      13                    B=WKPG.                     PG 3
2671     125                    OUT1=B.                     WORKPAGE
2672    1373                    B=IQFR.                     WD IQFR
2673     121                    OUT0=B.                     IQFR
2674    2305                    A1=A1.
2675    2345                    BEX1 A1=A1.
2676     115                    A3=B.                       A3=IQFR VALUE
                        *               IF HDR=EOP,THROW AWAY
2677    6301                    B=A3.
2700     125                    OUT1=B.
2701      33                    B=ONE.
2702     121                    OUT0=B.
2703    2305                    A1=A1.                  D2
2704    2345                    BEX1 A1=A1.
2705     101                    B=B.
2706    3627                    IF ABT STEP ELSE SKIP.
2707      23
2710    1436                    GOTO BACK.
2711    2305                     A1=A1.                         D3
2712    2345                      BEX1 A1=A1.
2713     101                    B=B.
2714    3627                    IF ABT STEP ELSE SKIP.
2715      23
2716    1436                    GOTO BACK.
2717    2305                    A1=A1.                  D4
2720    2345                      BEX1 A1=A1.
2721     101                    B=B.
2722    3627                     IF ABT STEP ELSE SKIP.
2723      23
2724    1436                    GOTO BACK.
2725    2305                    A1=A1.                  D5
2726    2345                    BEX1 A1=A1.
2727     101                    B=B.
2730    3627                    IF ABT STEP ELSE SKIP.
2731      23
2732    1436                    GOTO BACK.
2733       3
2734    2526                    CALL RD.                        D6
2735     101                    B=B.
2736    3627                    IF ABT STEP ELSE SKIP.
2737      23
2740    1436                    GOTO BACK.
2741      13                    B=ZERO.                 WD 0
2742     121                    OUT0=B.
2743       3
```

```
2744    1626                    CALL LPC.               FORM LPC IN A1
2745    2305                    A1=A1.
2746    2345                    BEX1 A1=A1.             GET LPC WD
2747    4607                    IF LC1 STEP.            RESETS LC1
2750    2401                    B=A1 EQV B.             LPC OK?
2751    3707                    IF ABT SKIP ELSE STEP.
2752     123
2753    7636                    GOTO CSTPP.             NO
2754     201                    B=1.                    YES
2755    2007                    IF LST SET LC1 STEP.    SET LC1
2756     607                    STEP.
2757      53                    B=2.
2760       3
2761    2466                    CALL WD.
2762       3
2763    2526                    CALL RD.
2764     161                    BS=B.
2765     101                    B=B.
2766    2627                    IF LST STEP ELSE SKIP.  R/S MODE?
2767     143
2770    5536                    GOTO IQLINK.            YES, LINK IQ
                        CSTPP.
2771     133                    B=5.                    WD. 5
2772     121                    OUT0=B.
2773    2305                    A1=A1.
2774    2345                    BEX1 A1=A1.
2775     105                    A1=B.                     A1=D6
2776      33                    B=TABL.                   CONV TABL PG
2777     125                    OUT1=B.                   PG 4
3000    2321                    OUT0=A1.                  WD D6
3001    2305                    A1=A1.
3002    2345                    BEX1 A1=A1.
3003     105                    A1=B.                     A1=D0=FAD=WRT ADDR
3004    6325                    OUT1=A3.                  PG IQFR
3005      53                    B=2.                      WD 2
3006     121                    OUT0=B.
3007    2305                    A1=A1.
3010    2345                    BEX1 A1=A1.               B=D3
3011     161                    BS=B.                     SHIFT RT
3012     161                    BS=B.                     5 TIMES
3013     161                    BS=B.
3014     161                    BS=B.
3015     161                    BS=B.
3016     101                    B=B.                      SET COND F/FS
3017    2707                    IF LST SKIP ELSE STEP.    ALT ROUT USED?
3020     143
3021     736                    GOTO DO.                NO
3022      33                    B=VALT1.                YES
3023     111                    A2=B.                     A2=UST ROUTE
3024    2401                    B=A1 EQV B.               A1=A2?
3025    3627                    IF ABT STEP ELSE SKIP.
3026     143
3027     676                    GOTO OTHR.                YES
3030    4305                    A1=A2.                    NO
3031     143
3032     736                    GOTO DO.                  DO=1ST ROUTE=A1
                        OTHR.
3033      73                    B=VALT0.                USE OTHER RTE
3034     105                    A1=B.
                        DO.
```

```
3035      53                B=BLDR.                    PG 5
3036     125                OUT1=B.                    ACK/NAK BLDR
3037     113                B=AKFR.                    WD 4
3040     121                OUTO=B.                    AKFR
3041    2305                A1=A1.
3042    2345                BEX1 A1=A1.
3043     111                A2=B.                      A2=AKFR
3044    4321                OUTO=A2.                   WD#=AKFR
3045    2301                B=A1.                    WRT DO TO BLDR
3046       3
3047    2606                CALL WR.
3050    6325                OUT1=A3.                   PG IQFR
3051     133                B=5.                     WD #5
3052     121                OUTO=B.                    D6
3053    2305                A1=A1.
3054    2345                BEX1 A1=A1.
3055     105                A1=B.                      A1=D6
3056      53                B=BLDR.                     PUT D6
3057     125                OUT1=B.                    AS D5
3060    4211                A2=A2 + 1.                 ON BLDR
3061     113                B=4.
3062    4121                OUTO=A2+B.                   PAGE
3063    2301                B=A1.
3064       3
3065    2606                 CALL WR.
3066    6325                OUT1=A3.                   GET D5
3067     113                B=4.                     & PUT AS
3070     121                OUTO=B.                    D6 ON
3071    2305                A1=A1.                     BLDR PG
3072    2345                BEX1 A1=A1.
3073     105                A1=B.
3074      53                B=BLDR.
3075     125                OUT1=B.
3076    4211                A2=A2 + 1.
3077     113                B=4.
3100    4121                OUTO=A2+B.
3101    2301                B=A1.
3102       3
3103    2606                CALL WR.
3104    4627                IF LC1 STEP ELSE SKIP.     LPC OK?
3105     143
3106    2256                GOTO ACK.                  YES, BLD ACK
3107    4013                B=128.                     NO, BLD NAK
3110     143
3111    2316                GOTO AKNK.
                      ACK.
3112     201                B=1.                         SET LC1
3113    2007                IF LST SET LC1 STEP.
                      AKNK.
3114    4211                A2=A2 + 1.                 WRT D3=B
3115    4321                OUTO=A2.
3116       3
3117    2606                 CALL WR.
3120    4211                A2=A2+1.                 SET D4=0
3121      13                B=ZERO.
3122       3
3123    2606                 CALL WR.
3124    6325                OUT1=A3.                    MOVE D1
3125      13                B=ZERO.
3126     121                OUTO=B.
```

```
3127    2305                A1=A1.
3130    2345                BEX1 A1=A1.
3131     105                A1=B.
3132      53                B=BLDR.
3133     125                OUT1=B.
3134    4211                A2=A2 + 1.
3135     113                B=4.
3136    4621                OUT0=A2-B.
3137    2301                 B=A1.
3140       3
3141    2606                CALL WR.
3142    6325                OUT1=A3.                MOVE D2
3143     201                B=1.
3144     121                OUT0=B.
3145    2305                A1=A1.
3146    2345                BEX1 A1=A1.
3147     105                A1=B.
3150      53                B=BLDR.
3151     125                OUT1=B.
3152    4211                A2=A2 + 1.
3153     113                B=4.
3154    4621                OUT0=A2-B.
3155    2301                B=A1.
3156       3
3157    2606                CALL WR.
3160    7773                B=EOP.                  FORM D7=EOP
3161    4211                A2=A2 + 1.
3162    4321                OUT0=A2.
3163       3
3164    2606                CALL WR.
3165    1505                A1=0.                   INIT LPC
3166     113                B=AKFR.                 GET AKFR
3167     121                OUT0=B.
3170    2305                A1=A1.
3171    2345                BEX1 A1=A1.
3172       1                B=B+1.
3173     121                OUT0=B.                 WD=AKFR+1
3174     153                B=6.
3175     115                A3=B.
                    ALPCK.
3176    2305                A1=A1.
3177    2345                BEX1 A1=A1.
3200    2505                A1=A1 XOR B.
3201    6215                A3=A3+1.
3202    3627                 IF ABT STEP ELSE SKIP.
3203     143
3204    4336                GOTO NOAEOP.
3205     111                A2=B.
3206    7773                B=EOP.
3207    4411                A2=A2 EQV B.
3210    3707                IF ABT SKIP ELSE STEP.
3211     143
3212    3756                GOTO ALPCK.
3213     143
3214    4656                GOTO SUCEOP.
                    NOAEOP.
3215     113                B=AKFR.
3216       3
3217    2466                CALL WD.
3220       3
```

```
3221    2526                    CALL RD.
3222     111                    A2=B.
3223     173                    B=7.
3224    4101                    B=A2+B.
3225       3
3226    2466                    CALL WD.
3227    7773                    B=EOP.
3230       3
3231    2606                    CALL WR.
                        SUCEOP.
3232    2301                    B=A1.
3233       3
3234    2606                    CALL WR.
3235     113                    B=AKFR.                 GET AKFR
3236     121                    OUT0=B.                 PUT INTO A1
3237    2305                    A1=A1.
3240    2345                    BEX1 A1=A1.
3241     105                    A1=B.
3242     233                    B=9.                    ADD 9
3243    2105                    A1=A1 + B.
3244     113                    B=AKFR.                 UPDATE AKFR
3245     121                    OUT0=B.
3246    2301                    B=A1.
3247       3
3250    2606                    CALL WR.
3251     133                    B=AKS.                  UPDATE AKS
3252     121                    OUT0=B.
3253    4004                    DEV1=128.               DISABLE AUTOINCR
3254    2305                    A1=A1.
3255    2345                    BEX1 A1=A1.
3256       1                    B=B + 1.                ONE MORE ACK/NAK
3257       3
3260    2606                    CALL WR.
3261       4                    DEV1=0.                 CLEAR
3262    4707                    IF LC1 SKIP ELSE STEP.  DID LPC CK?
3263      23
3264    1436                    GOTO BACK.              NO,DONT LINK PACKETT
                        *        CRT CONNECTED CIE MUST STRIP
                        *        OFF PROTOCOL CHARACTERS
                         IQLINK.
3265      13                    B=WKPG.
3266       3
3267    2426                    CALL PG.                    GET IQFR
3270    1373                    B=IQFR.
3271       3
3272    2466                     CALL WD.
3273       3
3274    2526                    CALL RD.
3275       3
3276    2426                    CALL PG.                    PG IQFR
3277    1521                    OUT0=0.                     WD 0
3300     133                    B=ENQ.                  LD HDR CHARS
3301       3
3302    2606                     CALL WR.
3303      13                    B=ZERO.
3304       3
3305    2606                     CALL WR.
3306    4033                    B=SOH.
3307       3
3310    2606                    CALL WR.
```

```
3311    7773                    B=AD1.
3312       3
3313    2606                    CALL WR.
3314    7773                    B=AD2.
3315       3
3316    2606                      CALL WR.
3317    4053                    B=STX.
3320       3
3321    2606                    CALL WR.
                      *               CHNG EOP TO ETX
3322     153                    B=6.
3323     115                    A3=B.                   WD PTR
3324    6321                    OUTO=A3.
                       LEOP.
3325    2305                    A1=A1.
3326    2345                    BEX1 A1=A1.
3327     111                    A2=B.
3330    7773                    B=EOP.
3331    4411                    A2=A2 EQV B.
3332    3627                    IF ABT STEP ELSE SKIP.=EOP?
3333     143
3334    7256                    GOTO CNGEOP.            YES
3335    6215                    A3=A3+1.                        INCR WD PTR
3336    3707                    IF ABT SKIP ELSE STEP. LST WD?
3337     143
3340    6536                    GOTO LEOP.              NO
                       NEOPER.
3341    7713                    B=252.                  *TEM* 6,NO EOP
3342     121                    OUTO=B.                         FORM NULL PACKET
3343      73                    B=ETX.
3344       3
3345    2606                     CALL WR.
3346       3
3347    2606                    CALL WR.
3350       3
3351    2606                    CALL WR.
                       CNGEOP.
3352    6321                    OUTO=A3.
3353      73                    B=ETX.
3354       3
3355    2606                    CALL WR.
3356      53                    B=2.
3357     115                    A3=B.
3360      73                    B=3.
3361     121                    OUTO=B.
3362    1505                    A1=0.
                      *               CALC BCC
                       BCC.
3363    6215                    A3=A3+1.
3364    3627                    IF ABT STEP ELSE SKIP. LST WD?
3365     143
3366    7036                    GOTO NEOPER.
3367    2305                    A1=A1.
3370    2345                     BEX1 A1=A1.
3371    2505                    A1=A1 XOR B.
3372     111                    A2=B.
3373      73                    B=ETX.
3374    4411                    A2=A2 EQV B.            =ETX?
3375    3707                    IF ABT SKIP ELSE STEP.
3376     143
```

```
3377    7476                GOTO BCC.                       NO
3400    2301                B=A1.                       YES, WRT BCC
3401       3
3402    2606                CALL WR.
3403       4                DEV1=0.                         CLEAR DEV
3404      13                B=WKPG.                     YES,LINK TO IQ
3405     125                OUT1=B.                     UPDATE CURR Q SIZE
3406    1333                B=IQNOW.                    IQNOW
3407     121                OUT0=B.
3410    4004                DEV1=128.                   DISABLE AUTOINCR
3411    2305                A1=A1.
3412    2345                BEX1 A1=A1.
3413       1                B=B + 1.                    INC
3414       3
3415    2606                CALL WR.
3416    1373                B=IQFR.                     UPDATE IQFR
3417     121                OUT0=B.
3420    2305                A1=A1.
3421    2345                BEX1 A1=A1.
3422       1                B=B + 1.                    INC
3423     105                A1=B.                       CHECK FOR
3424     213                B=VIQMAX.                    WRAPAROUND
3425     111                A2=B.                       A2=IQMAX
3426      73                B=3.
3427    4111                A2=A2 + B.                  PT INTO Q
3430    2301                B=A1.                       A1=NEW IQFR
3431    4411                A2=A2 EQV B.                A1=A2?
3432    3627                IF ABT STEP ELSE SKIP.
3433      73                B=3.                        YES,RESET IQFR
3434     607                STEP.
3435     105                A1=B.
3436    1373                B=IQFR.                     WD IQFR
3437     121                OUT0=B.
3440    2301                B=A1.                      WRT TO MEM
3441       3
3442    2606                CALL WR.
3443       4                DEV1=0.                     CLEAR
3444      23
3445    1436                GOTO BACK.                  EXIT
                    *
                    *        *** #8 NCU INT1,2 MODULE ***
                     INT1-2.
3446     607                STEP.
3447     607                STEP.
3450    3004                DEV1=96.                    ACCESS NCU
3451      33                B=MAIL.                     MAILBOX PG
3452       3
3453    2426                CALL PG.
3454     113                B=ICIE.                     CIE INT WD
3455       3
3456    2466                CALL WD.
3457      13                B=ZERO.                     SET=0
3460       3
3461    2606                CALL WR.                    WRITE1,2
3462      20                DEV0=1.                     INT NCU
                    *         SET REGWD FOR WT TIMEOUTS
3463       4                DEV1=0.                     ACCESS CIE MEM
3464      13                B=WKPG.                     WORKPAGE
3465       3
3466    2426                CALL PG.
```

```
3467    1613                    B=BEGWD.                    BEGWD
3470       3
3471    2466                    CALL WD.
3472      33                    B=ONE.                      SET BEGWD
3473       3
3474    2606                    CALL WR.
3475      23
3476    1436                    GOTO BACK.
                        *
                        *       *** #9 EXT TO CIE MODULE ***
                        *
                        EXXCIE.
3477     607                    STEP.
3500     607                    STEP.
3501       4                    DEV1=0.                     CLEAR
3502      13                    B=WKPG.
3503       3
3504    2426                    CALL PG.                    WORKPAGE
3505    1433                     B=OQNOW.
3506       3
3507    2466                    CALL WD.
3510       3
3511    2526                     CALL RD.
3512     401                    B=0 EQV B.
3513    3707                    IF ABT SKIP ELSE STEP.
3514      43
3515    2076                    GOTO STOTCK.
3516     273                    B=VOQTOP.
3517     105                    A1=B.
3520    2301                    B=A1.                       A1=FREE PG
3521       3
3522    2126                    CALL PG.                    BLAST TRANSFER
3523      13                    B=ZERO.                     OUT BUF - CIE
3524       3
3525    2466                    CALL WD.
3526    4004                    DEV1=128.
                        *               RD ENQ
3527    2325                    OUT1=A1.                          PG A1
3530    1521                    OUT0=0.
3531    4044                     DEV1=130.
3532    4064                    DEV1=131.
3533    4004                     DEV1=128.
3534    2345                    BEX1 A1=A1.
3535     607                    STEP.
3536     115                    A3=B.
3537     133                    B=ENQ.
3540    6415                    A3=A3 EQV B.
3541    3707                    IF ABT SKIP ELSE STEP. =ENQ?
3542      43
3543    2076                    GOTO STOTCK.
                        *               YES, SND ACK AFTER 7 MSEC
3544    2315                    A3=A1.
3545       3
3546    1306                    CALL WT7MS.
3547    6305                    A1=A3.                    SWAP A1,A3
3550    4004                    DEV1=128.
3551    2325                    OUT1=A1.
3552     221                     OUT0=1.
3553     153                    B=ACK.
3554     131                    OUT2=B.
```

```
3555    4104                DEV1=132.
3556    4004                DEV1=128.
3557      53                B=2.
3560     111                A2=B.                    A2=WD PTR
3561    2325                OUT1=A1.
3562    1521                OUT0=0.
3563    6355                BEX3 A3=A3.              LD STRT TM
3564     131                OUT2=B.
3565     607                STEP.
                    EXOLKR.
3566    6355                BEX3 A3=A3.
3567     115                A3=B.                    A3=CURR CLK TM
3570    2325                OUT1=A1.
3571    1521                OUT0=0.
3572    2305                A1=A1.
3573    2345                BEX1 A1=A1.
3574    6715                A3=A3-B-1.               A3=DFF
3575     373                B=15.                    B=MAX DFF
3576    6215                A3=A3+1.
3577    6215                A3=A3+1.
3600    6715                A3=A3-B-1.
3601    1627                IF AOV STEP ELSE SKIP.   A3>MAXDFF?
3602      43
3603    2076                GOTO STOTCK.             YES,ERR COND
3604    7707                IF EXT SKIP ELSE STEP.   EXT ON?
3605     163
3606    6276                GOTO BUFLKR.             NO
3607     335                OUT3 AMPCR=AMPCR.                YES, RESET EXT
3610     335                OUT3 AMPCR=AMPCR.
3611    3004                DEV1=96.                         ACCESS NCU
3612      13                B=ZERO.
3613       3
3614    2426                CALL PG.
3615       3
3616    2466                CALL WD.
3617       3
3620    2526                CALL RD.
3621     101                B=B.
3622    3627                IF ABT STEP ELSE SKIP.   WT REC?
3623     163
3624    5136                GOTO  WTREE.             YES
3625      33                B=MAIL.
3626       3
3627    2426                CALL PG.
3630     113                B=ICIE.
3631       3
3632    2466                CALL WD.
3633    4013                B=128.
3634       3
3635    2606                CALL WR.
3636      20                DEV0=1.                          INT NCU-RD
3637       4                DEV1=0.
3640    4004                DEV1=128.
3641    2325                OUT1=A1.
3642    1521                OUT0=0.
3643     163
3644    6276                GOTO BUFLKR.             NO, THROW AWAY
                    WTREE.
3645      53                B=2.                     YES,RESND IT
3646       3
```

```
3647    2426                CALL PG.
3650    7733                B=253.              MRK OUT PG EMPTY
3651       3
3652    2466                 CALL WD.
3653      13                B=ZERO.
3654       3
3655    2606                CALL WR.
3656       3
3657    2606                CALL WR.
3660      33                B=MAIL.                     WRT 1,2 INT
3661       3
3662    2426                CALL PG.
3663     113                B=ICIE.
3664       3
3665    2466                CALL WD.
3666      13                B=ZERO.
3667       3
3670    2606                CALL WR.
3671      53                B=WTA.
3672       3
3673    2466                CALL WD.
3674       3
3675    2526                CALL RD.
3676     115                A3=B.
3677      33                B=WRA.
3700       3
3701    2466                CALL WD.
3702    6301                B=A3.
3703       3
3704    2606                CALL WR.
3705    1521                OUT0=0.
3706      20                DEV0=1.                     INT NCU
3707       4                DEV1=0.                     CLEAR
3710    4004                DEV1=128.
3711    2325                OUT1=A1.
3712    1521                OUT0=0.
              BUFLKR.
3713      13                 B=ZERO.                    GET BUF ST REG
3714     141                BEX0 B=B.
3715     101                B=B.
3716    2707                IF LST SKIP ELSE STEP.     OUT BUF FULL?
3717     163
3720    3556                 GOTO EXOLKR.          NO
3721    4004                DEV1=128.
3722    2325                OUT1=A1.                    YES, RD CHAR
3723    4321                OUT0=A2.
3724    4044                DEV1=130.
3725    4064                DEV1=131.
3726    4004                DEV1=128.
3727    2345                BEX1 A1=A1.
3730     607                 STEP.
3731     115                A3=B.
3732      73                B=ETX.
3733    6415                A3=A3 EQV B.
3734    3627                IF ABT STEP ELSE SKIP. =ETX?
3735     163
3736    7216                GOTO WATBCC.          YES, RD BCC
3737    4211                A2=A2+1.                    NO,INC WD PTR
3740    4004                  DEV1=128.
3741    2325                OUT1=A1.
```

```
3742    1521                    OUT0=0.
3743    6355                    BEX3 A3=A3.
3744     131                     OUT2=B.
3745     607                     STEP.
3746     163
3747    3556                    GOTO EXOLKR.
                        WATBCC.
3750       3
3751     506                    CALL LKOTB.
3752    4004                    DEV1=128.
3753    4211                    A2=A2+1.
3754    2325                     OUT1=A1.
3755    4321                    OUT0=A2.
3756    4044                    DEV1=130.
3757    4064                    DEV1=131.
3760    4004                    DEV1=128.
3761    2345                    BEX1 A1=A1.
                        *               SND ACK AFTER 7MSEC
3762    2315                    A3=A1.
3763       3
3764    1306                    CALL WT7MS.
3765    6305                     A1=A3.                 SWAP A1,A3
3766    4004                    DEV1=128.
3767    2325                    OUT1=A1.
3770    1521                    OUT0=0.
3771     153                      B=ACK.
3772     131                    OUT2=B.
3773    4104                    DEV1=132.
3774    4004                    DEV1=128.
                        *               READ EOT
3775    6355                    BEX3 A3=A3.            LD .STRT TM
3776       3
3777    2606                    CALL WR.
                        LKER3.
4000    6355                      BEX3 A3=A3.
4001     115                    A3=B.                  A3=CURCLK TM
4002       3
4003    2526                    CALL RD.                        B=STRT TM
4004    6715                    A3=A3-B-1.             A3=DFF
4005     373                    B=15.                  B=MAX DFF
4006    6215                     A3=A3+1.
4007    6215                    A3=A3+1.
4010    6715                    A3=A3-B-1.
4011    1627                    IF AOV STEP ELSE SKIP. A3>MAXDFF?
4012     203
4013     636                    GOTO BLPPC.            YES, ERR COND
4014      13                    B=ZERO.
4015     141                    BEX0 B=B.
4016     101                    B=B.
4017    2707                    IF LST SKIP ELSE STEP. OUT BUF FULL?
4020     203
4021      16                    GOTO LKER3.            NO
4022    4004                    DEV1=128.
4023    2325                    OUT1=A1.
4024    1521                    OUT0=0.
4025    4044                    DEV1=130.
4026    4064                    DEV1=131.
4027    4004                    DEV1=128.
4030    2345                    BEX1 A1=A1.
                        *               BUILD LOOP PROTOCOL CHARS
```

```
                        BLPPC.
4031        4                   DEV1=0.
4032     2301                   B=A1.
4033        3
4034     2426                   CALL PG.
4035      113                   B=4.                    SET D5=VPDDLID
4036        3
4037     2466                   CALL WD.
4040      133                   B=VPDDLID.
4041        3
4042     2606                   CALL WR.
4043      113                   B=VOLID.                        SET D6=VOLID
4044        3
4045     2606                    CALL WR.
4046       53                   B=2.
4047        3
4050     2466                   CALL WD.
4051       13                   B=ZERO.                         SET D3,D4=0
4052        3
4053     2606                   CALL WR.
4054        3
4055     2606                   CALL WR.
4056       13                   B=ZERO.
4057        3
4060     2466                   CALL WD.
4061       33                   B=ONE.                  SET D1=1
4062        3
4063     2606                   CALL WR.
4064       13                   B=WKPG.                         WKPG
4065        3
4066     2426                   CALL PG.
4067     4004                   DEV1=128.                       DISABLE AUTOINCR
4070     4613                   B=MSGNO.                        GET MSGNO
4071        3
4072     2466                   CALL WD.
4073        3
4074     2526                   CALL RD.
4075        1                   B=B+1.                  INCR MSGNO
4076     3627                   IF ABT STEP ELSE SKIP.
4077       13                    B=ZERO.
4100      607                   STEP.
4101        3
4102     2606                   CALL WR.
4103      111                   A2=B.                   A2=MSGNO
4104        4                   DEV1=0.
4105     2301                   B=A1.
4106        3
4107     2426                   CALL PG.
4110      201                   B=1.
4111        3
4112     2466                   CALL WD.                        SET D2=A2
4113     4301                   B=A2.
4114        3
4115     2606                   CALL WR.
                        *               REPLACE ETX BY EOP
4116      133                   B=5.
4117      111                    A2=B.                  WD PTR
                        REPLETX.
4120     4211                   A2=A2+1.                        INCR PTR
4121     3627                   IF ABT STEP ELSE SKIP. LAST WD?
```

```
4122      203
4123     3076                GOTO WRETXM.            YES,ERROR COND
4124     4321                OUT0=A2.
4125        3
4126     2526                CALL RD.
4127      115                A3=B.
4130       73                B=ETX.
4131     6401                B=A3 EQV B.
4132     3707                 IF ABT SKIP ELSE STEP.          =ETX?
4133      203
4134     2416                GOTO REPLETX.           NO
4135     4321                OUT0=A2.                        YES
4136     7773                B=EOP.
4137        3
4140     2606                CALL WR.
4141      203
4142     3216                GOTO INSRLPC.           FORM LPC
                        WRETXM.
4143     7753                B=254.                  MAKE EOP
4144      121                OUT0=B.
4145     7773                B=EOP.
4146        3
4147     2606                CALL WR.
                        INSRLPC.
4150        3
4151     1626                 CALL LPC.
4152     2331                OUT2=A1.
4153      607                STEP.
4154       13                B=WKPG.
4155        3
4156     2426                CALL PG.                  WORKPAGE
4157     1433                B=OQNOW.                  GET OQNOW
4160        3
4161     2466                CALL WD.
4162       33                B=ONE.
4163        3
4164     2606                CALL WR.                  WRT BACK TO MEM
4165     3173                B=103.                  INIT #TMS IND
4166        3
4167     2466                CALL WD.
4170       13                B=ZERO.
4171        3
4172     2606                CALL WR.
4173        4                DEV1=0.                   CLEAR DEV
4174       23
4175     1436                GOTO BACK.                 RETURN TO BKGND MODULE
                             ENDT.

THE NUMBER OF ERRORS= 0
TTO --  STOP
>
```

GAT 7. DAT

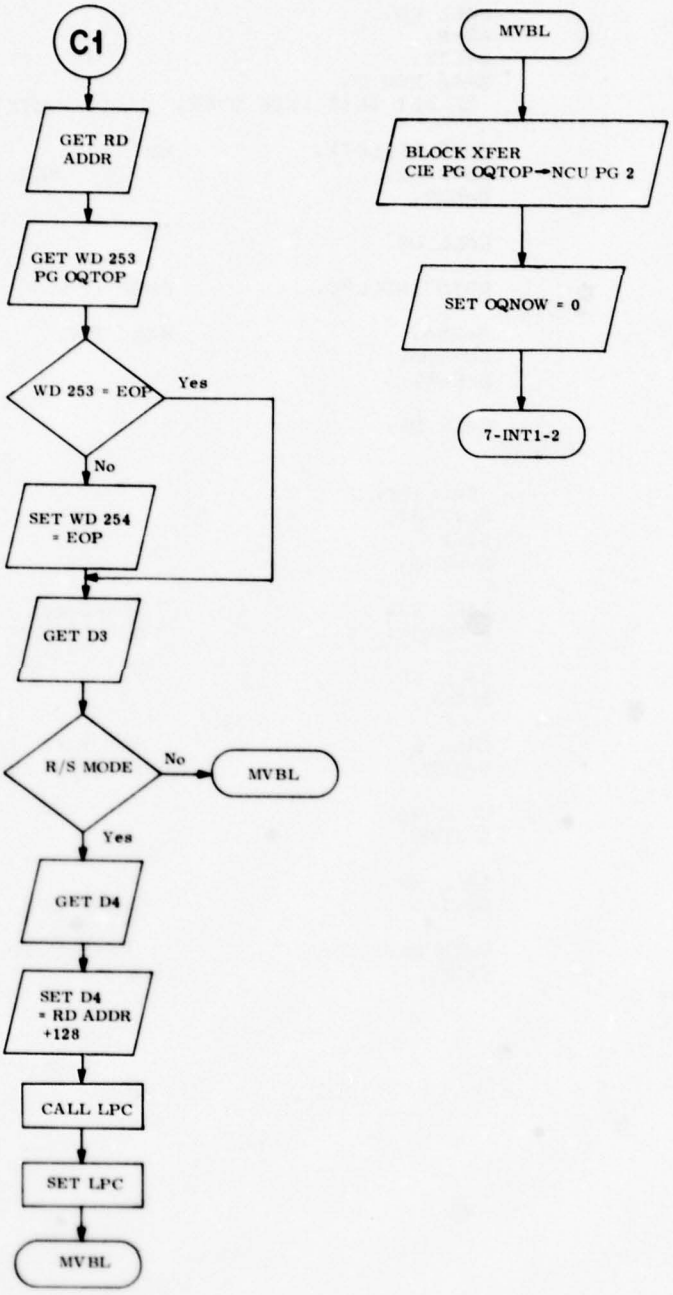


Figure 2-7. GAT7.DAT

GAT 7. DAT (cont.)

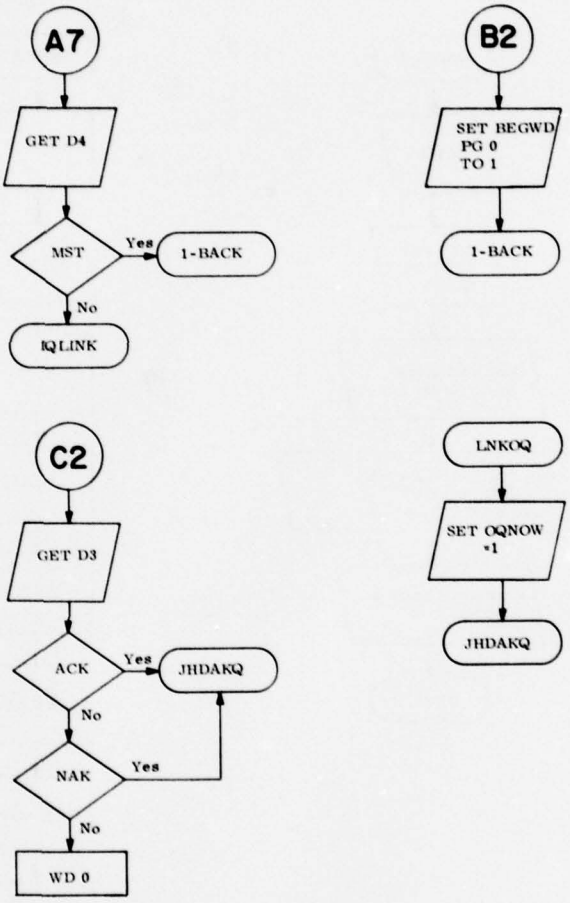


Figure 2-7. (Cont.)

GAT . DAT (cont.)

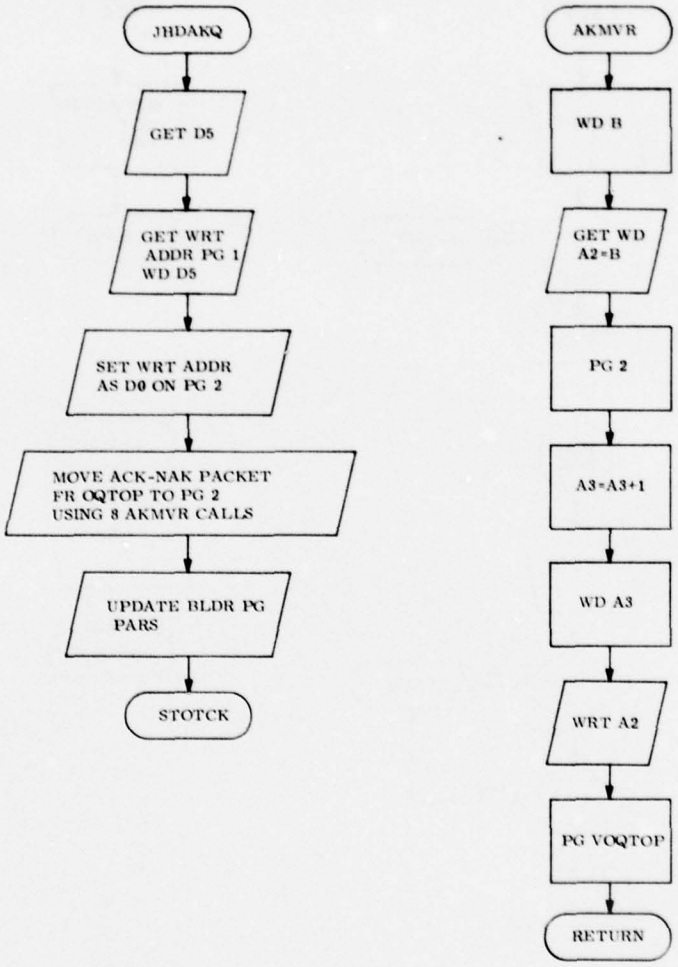


Figure 2-7. (Cont.)

```
MCR>RUN [20,20]MDMPL
PLEASE ENTER INPUT SOURCE FILE NAME
GAT7.DAT
PLEASE ENTER OUTPUT OBJECT FILE NAME
GAT7.OBJ
WAIT FOR FIRST PASS - SCAN FOR LABELS
  250 RECORDS READ
  500 RECORDS READ
  750 RECORDS READ
 1000 RECORDS READ
 1250 RECORDS READ
 1500 RECORDS READ
MPAD     CODE
```

```
                        $12BIT
                         PROGRAM-ID CIE.
                        *
                        *   **** CIE NODAL SOFTWARE ****
                        *
                         WKPG VALUE 0.
                         IQFR VALUE 47.
                         TABL VALUE 1.
                         AKFR VALUE 4.
                         BLDR VALUE 2.
                         IQNOW VALUE 45.
                         AKS VALUE 5.
                         IQMAX VALUE 44.
                         MAIL VALUE 1.
                         ICIE VALUE 4.
                         ZERO VALUE 0.
                         ONE VALUE 1.
                         EOP VALUE 255.
                         RDA VALUE 0.
                         WRA VALUE 1.
                         WTA VALUE 2.
                         INCU VALUE 3.
                         AKS VALUE 5.
                         ALT1 VALUE 1.
                         ALT0 VALUE 1.
                         OQNOW VALUE 49.
                         OQTOP VALUE 50.
                         OQFR VALUE 51.
                         IQTOP VALUE 46.
                         BEGWD VALUE 56.
                         LSTWT VALUE 53.
                         DFFWT VALUE 54.
                         OQMAX VALUE 48.
                         MAXCK VALUE 248.
                         MAXTR VALUE 147.
                         D3 VALUE 2.
                         AKCUR VALUE 3.
                         LOOPNO VALUE 253.
                         SYSNO VALUE 254.
                         OLID VALUE 149.
                         PDDLID VALUE 150.
                         ADDLID VALUE 151.
                         MSGNO VALUE 152.
                         COUNT VALUE 180.                BLAST TIMING PARAMETER
                         VLOOPNO VALUE 4.
                         VSYSNO VALUE 11.
```

```
                        VAKCUR VALUE 6.
                        VRDA VALUE 3.
                        VWRA VALUE 4.
                        VWTA VALUE 4.
                        VINCU VALUE 0.
                        VAKS VALUE 0.
                        VAKFR VALUE 6.
                        VALT1 VALUE 1.
                        VALTO VALUE 3.
                        VIQMAX VALUE 10.
                        VIQNOW VALUE 0.
                        VIQTOP VALUE 3.
                        VIQFR VALUE 3.
                        VOQMAX VALUE 1.
                        VOQNOW VALUE 0.
                        VOQTOP VALUE 13.
                        VOQFR VALUE 0.
                        VDFFWT VALUE 4.                 #TICKS
                        VMAXTR VALUE 3.
                        VMAXCK VALUE 25.                #TICKS
                        VICIE VALUE 128.
                        VOLID VALUE 7.
                        VPDDLID VALUE 5.
                        VADDLID VALUE 1.
                        IC1 VALUE 85.           FOR CONT PACK
                        IC2 VALUE 170.
0         3
1      2476                     GOTO INIT.
                       *                DEBUG JUMPS
2        23
3      2036                     GOTO BACK.              HRWR ERR
4        23
5      6416                     GOTO CONT.
6        43
7      3776                     GOTO INTRD.
10       63
11      556                     GOTO INTO.
12       63
13     4316                     GOTO OUTQ.
14      103
15     6516                     GOTO INQ.
16      143
17       36                     GOTO INT1-2.
20      143
21      656                     GOTO EXXCIE.
                       *                SUB TO MOVE ACKS-NAKS
                        AKMVR.
22      121                     OUT0=B.
23     2305                     A1=A1.
24     2345                     BEX1 A1=A1.
25      111                     A2=B.
26       53                     B=BLDR.
27      125                     OUT1=B.
30     6215                     A3=A3+1.
31     6321                     OUT0=A3.
32     4331                     OUT2=A2.
33      607                     STEP.
34      333                     B=VOQTOP.
35      125                     OUT1=B.
36      657                     JUMP.
```

```
                        *               7 MSEC WAIT SUB.
                         WT7MS.
 37      7613                   B=248.
 40       105                   A1=B.
 41      1511                   A2=0.
                         INLP1.
 42      4211                   A2=A2+1.
 43      3707                   IF ABT SKIP ELSE STEP.
 44         3
 45      1056                   GOTO INLP1.
 46      1511                   A2=0.
 47      2205                   A1=A1+1.
 50      3707                   IF ABT SKIP ELSE STEP.
 51         3
 52      1056                   GOTO INLP1.
 53       657                   JUMP.
                        *
                        *
                        *         SUBROUTINE TO PUT LPC IN A1
                         LPC.
 54         4                   DEV1=0.
                        *                ELIMINATE HANGS
 55      7733                   B=253.
 56       121                   OUT0=B.
 57      2305                   A1=A1.
 60      2345                   BEX1 A1=A1.
 61       101                    B=B.
 62      3627                   IF ABT STEP ELSE SKIP.
 63         3
 64      1656                   GOTO LPCINIT.
 65      7753                   B=254.
 66       121                   OUT0=B.
 67      7773                   B=255.
 70       131                   OUT2=B.
 71       607                   STEP.
                         LPCINIT.
 72      1521                   OUT0=0.
 73      1505                   A1=0.
                         LPCILP.
 74      2305                   A1=A1.                    GET WD
 75      2345                   BEX1 A1=A1.
 76      2505                   A1=A1 XOR B.              XOR
 77       101                   B=B.                      SET COND F/FS
100      3707                   IF ABT SKIP ELSE STEP.    STOP IF EOP
101         3
102      1716                   GOTO LPCILP.
103       657                   JUMP.
                        *
                        *
                        *        PAGE SET, WORD SET,
                        *        READ, WRITE MEMORY SUBROUTINES
                         PG.                               PAGE SET SUB
104       125                   OUT1=B.                   PAGE IN B REG
105       657                   JUMP.                     RETURN
                         WD.                               WORD SET SUB
106       121                   OUT0=B.                   WORD LOC IN B
107       657                   JUMP.                     RETURN
                         RD.                               READ FR MEM SUB
110      2305                   A1=A1.                    PROVIDE 10 CLOCKS
111      2345                   BEX1 A1=A1.               RD INTO B REG
```

```
112      657                JUMP.                      RETURN
                    WR.                                WRITE FR MEM SUB
113      131                OUT2=B.                    FROM B
114      657                JUMP.                      RETURN
                   *
                   *        BLAST TRANSFER SUBROUTINE
                    BLAST.
115     5513                B=COUNT.                   SET CTR
                    AGAIN.
116        1                B=B + 1.
117     3707                IF ABT SKIP ELSE STEP.     TEST CTR
120        3
121     2356                GOTO AGAIN.                   NO
122      657                JUMP.                      YES, RETURN
                   *
                    INIT.
123      335                OUT3 AMPCR=AMPCR.
124      335                OUT3 AMPCR=AMPCR.       ACCESS NCU MEM
125        3
126      766                CALL WT7MS.             GIVE NCU TM
127        3
130      766                CALL WT7MS.
                   *              FAKE BLAST HST-CIE
131        4                DEV1=0.
132     4351                BEX2 A2=A2.
133      753                B=30.
134      125                OUT1=B.
135     1521                 OUT0=0.
136      607                STEP.
137       44                  DEV1=2.
140        3
141     2326                CALL BLAST.
142       24                DEV1=1.
143      607                STEP.
144     4351                BEX2 A2=A2.
145        4                DEV1=0.
146     1521                OUT0=0.
147      607                  STEP.
150     3004                DEV1=96.
151       33                B=MAIL.
152        3
153     2106                CALL PG.
154       13                B=RDA.
155        3
156     2146                CALL WD.
157       73                B=VRDA.
160        3
161     2266                CALL WR.
162      113                B=VWRA.
163        3
164     2266                CALL WR.
165      113                B=VWTA.
166        3
167     2266                CALL WR.
170       13                B=VINCU.
171        3
172     2266                CALL WR.
173     4013                B=VICIE.
174        3
175     2266                CALL WR.
```

```
176      13                    B=VAKS.
177       3
200    2266                    CALL WR.
201    7773                    B=255.
202     121                    OUT0=B.
203     131                    OUT2=B.
204    1525                    OUT1=0.
205     121                     OUT0=B.
206     131                    OUT2=B.
207    1521                    OUT0=0.
                     *          LOAD WORKPAGE
210       4                    DEV1=0.                    CIE MEM
211      13                    B=WKPG.
212       3
213    2106                    CALL PG.
214      33                    B=ALT1.
215       3
216    2146                    CALL WD.
217      33                    B=VALT1.
220       3
221    2266                    CALL WR.
222      73                    B=VALT0.
223       3
224    2266                    CALL WR.
225    7773                    B=255.                     LOC 2-43
226     105                    A1=B.                      =0
227    1253                    B=42.
230    2605                    A1=A1 - B.
                     *          A1=COUNTER
                      INRP1.
231      13                    B=ZERO.
232       3
233    2266                    CALL WR.
234    2205                    A1=A1 + 1.
235    3707                    IF ABT SKIP ELSE STEP.
236       3
237    4636                    GOTO INRP1.
240    1313                    B=IQMAX.
241     121                    OUT0=B.
242     253                    B=VIQMAX.
243       3
244    2266                    CALL WR.
245      13                    B=VIQNOW.
246       3
247    2266                    CALL WR.
250      73                    B=VIQTOP.
251       3
252    2266                    CALL WR.
253      73                    B=VIQFR.
254       3
255    2266                    CALL WR.
256      33                    B=VOQMAX.
257       3
260    2266                    CALL WR.
261      13                    B=VOQNOW.
262       3
263    2266                    CALL WR.
264     333                    B=VOQTOP.
265       3
266    2266                    CALL WR.
```

```
267      13                    B=VOQFR.
270       3
271    2266                    CALL WR.
272      53                    B=2.
273    2605                    A1=A1-B.
                       INRP2.
274      13                    B=ZERO.
275       3
276    2266                    CALL WR.
277    2205                     A1=A1+1.
300    3707                    IF ABT SKIP ELSE STEP.
301       3
302    5716                     GOTO INRP2.
303    1553                    B=DFFWT.
304     121                    OUTO=B.
305     113                    B=VDFFWT.                  LOC 54
306       3
307    2266                    CALL WR.
310    2713                    B=92.                      LOC 55-146
311    2605                    A1=A1 - B.                 =0
                       INRP3.
312      13                    B=ZERO.
313       3
314    2266                    CALL WR.
315    2205                    A1=A1 + 1.
316    3707                    IF ABT SKIP ELSE STEP.
317       3
320    6256                    GOTO INRP3.
321    1613                    B=BEGWD.
322     121                    OUTO=B.
323     231                    OUT2=1.
                       *        1 NODE ON EACH LOOP
                       *        WILL HAVE ITS BEGWD INITIALLY ON
                       *        TO GENERATE THE 1ST WT
324       3
325    2266                    CALL WR.
                       *          CRT NODE USES LOCS. 149,150,151
326    4533                    B=OLID.
327       3
330    2146                    CALL WD.
331     173                    B=VOLID.
332       3
333    2266                    CALL WR.
334     133                    B=VPDDLID.
335       3
336    2266                    CALL WR.
337      33                    B=VADDLID.
340       3
341    2266                    CALL WR.
342    3013                    B=96.                      LOC 152-247
343    2605                    A1=A1 - B.                 =0
                       INRP4.
344      13                    B=ZERO.
345       3
346    2266                    CALL WR.
347    2205                    A1=A1 + 1.
350    3707                    IF ABT SKIP ELSE STEP.
351       3
352    7116                    GOTO INRP4.
353    7733                    B=LOOPNO.
```

```
354       3
355    2146                    CALL WD.
356     113                    B=VLOOPNO.
357       3
360    2266                    CALL WR.
361     273                    B=VSYSNO.
362       3
363    2266                    CALL WR.
                       *        LOAD CONVERSION PG
                       *        SPECIAL LIDS MAY ALSO
                       *        BE LOADED AT A LATER TIME
364      33                    B=TABL.
365       3
366    2106                    CALL PG.
367      13                    B=ZERO.
370       3
371    2146                    CALL WD.
372     105                    A1=B.
373      13                    B=ZERO.                 SND TO FAD 0
                     INRP5.
374       3
375    2266                    CALL WR.
376    2205                    A1=A1 + 1.
377    3707                    IF ABT SKIP ELSE STEP.
400       3
401    7716                    GOTO INRP5.
402      33                    B=ONE.
403       3
404    2146                    CALL WD.
405       3
406    2266                    CALL WR.
407      33                    B=ONE.
410       3
411    2266                    CALL WR.
412      33                    B=ONE.
413       3
414    2266                    CALL WR.
415     113                    B=4.
416       3
417    2266                    CALL WR.
420      53                    B=2.
421       3
422    2266                    CALL WR.
423     201                    B=1.
424       3
425    2266                    CALL WR.
426      73                    B=3.
427       3
430    2266                    CALL WR.
431      73                    B=3.
432       3
433    2266                    CALL WR.
434      73                    B=3.
435       3
436    2266                    CALL WR.
437      73                    B=3.
440       3
441    2266                    CALL WR.
442      73                    B=3.
443       3
```

```
444     2266                    CALL WR.
445     3773                    B=127.
446        3
447     2146                    CALL WD.
450      113                    B=VWTA.
451        3
452     2266                    CALL WR.
453     7753                    B=254.                  SYST BROAD
454        3
455     2146                    CALL WD.
456      113                    B=VWTA.
457        3
460     2266                    CALL WR.
                        *        LOAD ACK/NAK BUILDER PG
461       53                    B=BLDR.
462        3
463     2106                    CALL PG.
464       73                    B=3.
465        3
466     2146                    CALL WD.
467      153                    B=VAKCUR.
470        3
471     2266                    CALL WR.
472      153                    B=VAKFR.
473        3
474     2266                    CALL WR.
475       13                    B=VAKS.
476        3
477     2266                    CALL WR.
                        *        DATA MEM IS NOW INITIALIZED
                        *        SET NCU EXT TO FORCE IT
                        *        TO THE READ STATE
500       20                    DEV0=1.                 INT NCU
                        *
                        *        *** #1 BACKGROUND MODULE ***
                        *
                         BACK.
501      607                    STEP.
502      607                    STEP.
503        4                    DEV1=0.                 CLEAR
504       13                    B=WKPG.                 WORKPAGE
505        3
506     2106                    CALL PG.
507     7627                    IF EXT STEP ELSE SKIP.  INT PRES!
510       23
511     6416                    GOTO CONT.              EXIT #2
                         CKOTBF.
512       13                    B=ZERO.
513      141                    BEXO B=B.               GET STATUS BUF REG
514      101                    B=B.                    SET COND F/FS
515     2627                    IF LST STEP ELSE SKIP.  OUT BUF FULL?
516      143
517      656                    GOTO EXXCIE.             YES
                         CKINBF.
520      101                    B=B.
521      707                    IF MST SKIP ELSE STEP.  IN BUF EMPTY?
522       23
523     5036                    GOTO WTTM.              NO
524     1333                    B=IONOW.                YES
525        3
```

```
526     2146                    CALL WD.                    GET CURRENT
527        3
530     2206                    CALL RD.                    IQ SIZE
531      401                    B=0 EQV B.                  =0?
532     3627                    IF ABT STEP ELSE SKIP.
533       23
534     5036                    GOTO WTTM.                  YES
                        *        NO-BLAST TRANSFER CONTENTS ON
                        *        PG IQTOP TO INPUT BUFFER
535     1353                    B=IQTOP.                    GET IQTOP VALUE
536        3
537     2146                    CALL WD.
540        3
541     2206                    CALL RD.
542      105                    A1=B.                       SAVE A1=IQTOP
543        4                    DEV1=0.
544       30                    DEV2=1.
545      607                    STEP.
546        3
547     2106                    CALL PG.                    PG IQTOP
550       13                    B=ZERO.
551        3
552     2146                    CALL WD.
553      104                    DEV1=4.                     BLAST CIE-EXO
554        3
555     2326                    CALL BLAST.
556       24                    DEV1=1.                     TERMINATE BLAST
557      607                    STEP.
560       30                    DEV2=1.                   SND STATUS
561      607                    STEP.
562        4                    DEV1=0.                     CLEAR
563     1521                    OUT0=0.
564      607                    STEP.
565       13                    B=WKPG.                     WORKPAGE
566        3
567     2106                    CALL PG.
570        3
571      766                    CALL WT7MS.
572     1333                    B=IQNOW.                    GET IQNOW
573        3
574     2146                    CALL WD.
575        3
576     2206                    CALL RD.
577      105                    A1=B.                     DECR IQNOW
600       33                    B=ONE.
601     2205                    A1=A1+1.
602     2705                    A1=A1-B-1.
603     1333                    B=IQNOW.
604        3
605     2146                    CALL WD.
606     2301                    B=A1.
607        3
610     2266                    CALL WR.
611     1353                    B=IQTOP.                    GET IQTOP
612        3
613     2146                    CALL WD.
614        3
615     2206                    CALL RD.
616        1                    B=B + 1.                    INCR IQTOP
617      105                    A1=B.                       A1=NEW IQTOP
```

```
620     253                 B=VIQMAX.                  GET IQMAX
621     111                 A2=B.                     A2=IQMAX
622      73                 B=3.
623    4101                 B=A2 + B.                 B=IQMAX+ 3
624    2415                 A3=A1 EQV B.              IQTOP=B?
625    3707                 IF ABT SKIP ELSE STEP.
626      23
627    4656                 GOTO WRIQT.               NO
630      73                 B=3.                      YES, WRAPAROUND
631     105                 A1=B.
                  WRIQT.
632    1353                 B=IQTOP.                  WRITE IQTOP
633       3
634    2146                 CALL WD.
635    2301                 B=A1.
636       3
637    2266                 CALL WR.
640       4                 DEV1=0.                   ENABLE MAR INCR
                  *          LOOK FOR TIMEOUTS TO
                  *          GENERATE NEW WTS
                  WTTM.
641    7627                 IF EXT STEP ELSE SKIP.    INT PRES:
642      23
643    6416                 GOTO CONT.               EXIT
644      13                 B=ZERO.
645     141                 BEXO B=B.                 GET STATUS BUF REG
646     101                 B=B.                      SET COND F/FS
647    2627                 IF LST STEP ELSE SKIP.   OUT BUF FULL?
650     143
651     656                 GOTO EXXCIE.               YES
652    1613                 B=BEGWD.                  GET BEGIN WD
653       3
654    2146                 CALL WD.
655       3
656    2206                 CALL RD.
657     101                 B=B.                      SET COND F/FS
660    2707                 IF LST SKIP ELSE STEP.    BEG WD ON?
661      23
662    2036                 GOTO BACK.                NO
                  STOTCK.
663       4                 DEV1=0.
664      13                 B=WKPG.
665       3
666    2106                 CALL PG.
667    6355                 BEX3 A3=A3.               GET CLK TM
670     105                 A1=B.                     A1=CURCLK TIME
671    1533                 B=LSTWT.                  GET LAST WT
672       3
673    2146                 CALL WD.                  RECEPT TM
674       3
675    2206                 CALL RD.
676    2705                 A1=A1-B-1.               A1=DFF
677     113                 B=VDFFWT.                  GET MAX
700    2205                A1=A1+1.
701    2205                A1=A1+1.
702    2705                A1=A1-B-1.               A1>MAXDFF?
703    1707                IF AOV SKIP ELSE STEP.
704      23
705    2036                 GOTO BACK.               RETURN
706      20                 DEVO=1.                  SOFT INT
```

```
707      34                DEV3=1.                          HRD INT NCU
710       3
711     766                CALL WT7MS.              WAIT FOR SYNCH
712       3
713     766                CALL WT7MS.
714     335                OUT3 AMPCR=AMPCR.
715     335                OUT3 AMPCR=AMPCR.
716      63
717    4316                GOTO OUTQ.                AS IF WT RECEIVED
                     *
                     *      *** #2 NODE CONTROLLER MODULE ***
                     *
                     CONT.
720     607                STEP.
721     607                STEP.
722     335                 OUT3 AMPCR=AMPCR.
723     335                OUT3 AMPCR=AMPCR.                          RESET EXT
724    3004                DEV1=96.
725      13                B=ZERO.
726       3
727    2106                CALL PG.
730       3
731    2146                CALL WD.
732       3
733    2206                CALL RD.                  GET D1
734     101                B=B.                      SET COND F/FS
735    3707                IF ABT SKIP ELSE STEP.     D1=255?
736      23
737    7656                GOTO RS.                  NO
740       3
741    2206                CALL RD.                  YES, WT
742     111                A2=B.                     A2=D2
743    3004                DEV1=96.                  ACCESS NCU
744      33                B=MAIL.                   MAILBOX PG
745       3
746    2106                CALL PG.
747      13                B=ZERO.                   WD 0
750       3
751    2146                CALL WD.
752       3
753    2206                CALL RD.                  GET RD ADDR
754     105                A1=B.                     A1=RD ADDR
755    4401                B=A2 EQV B.               D2=RD ADDR?
756    3627                IF ABT STEP ELSE SKIP.
757      63
760    4316                GOTO OUTQ.                 YES, VALID WT
761     113                B=ICIE.                   WD ICIE
762       3
763    2146                CALL WD.
764    4013                B=128.                    SET MSB
765       3
766    2266                CALL WR.                  WRITE ICIE
767      20                DEV0=1.                   INT NCU - (READ)
770      23
771    2036                GOTO BACK.                RETURN TO BACK
                     RS.
772       4                DEV1=0.
773      13                B=WKPG.
774       3
775    2106                CALL PG.
```

```
 776    1373                B=IQFR.
 777       3
1000    2146                CALL WD.
1001       3
1002    2206                 CALL RD.
1003     115                A3=B.
1004       3
1005    2106                CALL PG.
1006      13                B=ZERO.
1007       3
1010    2146                CALL WD.
1011    3004                DEV1=96.
1012       3
1013    2106                CALL PG.
1014       3
1015    2146                 CALL WD.
1016    2404                 DEV1=80.
1017       3
1020    2326                CALL BLAST.
1021      24                DEV1=1.
1022       4                DEV1=0.
1023    1521                OUT0=0.
1024     607                STEP.
1025    3004                DEV1=96.                ACCESS NCU
1026      33                B=MAIL.                 MAILBOX PG
1027       3
1030    2106                CALL PG.
1031      13                B=ZERO.                 GET RD ADDR
1032       3
1033    2146                CALL WD.
1034       3
1035    2206                CALL RD.
1036     105                A1=B.                   A1=RD ADDR
1037       4                DEV1=0.                 RTN CIE MEM
1040    6301                B=A3.                   PG IQFR
1041       3
1042    2106                CALL PG.
1043      53                B=2.                    WD 2
1044       3
1045    2146                CALL WD.
1046       3
1047    2206                CALL RD.                GET D3
1050     161                BS=B.                   ROTATE 1 RT
1051     101                B=B.                    SET COND F/FS
1052    2707                IF LST SKIP ELSE STEP.  R/S BIT ON?
1053      43
1054    3776                GOTO INTRD.             NO
1055      73                B=3.                    YES
1056       3
1057    2146                CALL WD.                GET D4
1060       3
1061    2206                CALL RD.
                      *       CK IF MST OF D4 IS ON
1062     111                A2=B.                   A2=D4
1063    4013                B=128.
1064    4311                A2=A2.                  SET COND F/FS
1065     627                IF MST STEP ELSE SKIP.  MST ON?
1066    4611                A2=A2 - B.              YES
1067     607                STEP.
1070    4301                B=A2.
```

```
1071    2401                    B=A1 EQV B.                 D4=RD ADDR?
1072    3707                    IF ABT SKIP ELSE STEP.
                        *        IF YES, QUENCH BROADCAST
1073      63
1074     556                    GOTO INTO.
                        *         ROUTINE QUENCH'
                        *         USED TO QUENCH BROADCASTS
                         QUENCH.
1075      13                    B=WKPG.                     WKPG
1076       3
1077    2106                    CALL PG.
1100    6301                    B=A3.
1101       3
1102    2106                     CALL PG.
1103      53                     B=2.
1104       3
1105    2146                    CALL WD.
1106       3
1107    2206                    CALL RD.
1110     161                    BS=B.
1111     161                    BS=B.
1112     161                    BS=B.
1113     161                    BS=B.
1114     101                    B=B.
1115    2707                    IF LST SKIP ELSE STEP. CONTROL?
1116      23
1117    5476                    GOTO STOTCK.            NO,EXIT
1120      13                    B=ZERO.
1121       3
1122    2146                    CALL WD.
1123       3
1124    2206                    CALL RD.
1125     115                     A3=B.
1126    2533                    B=IC1.
1127    6401                    B=A3 EQV B.
1130    3707                    IF ABT SKIP ELSE STEP.
1131      23
1132    5476                    GOTO STOTCK.
1133       3
1134    2206                    CALL RD.
1135     115                    A3=B.
1136    5253                     B=IC2.
1137    6401                    B=A3 EQV B.
1140    3707                    IF ABT SKIP ELSE STEP.
1141      23
1142    5476                    GOTO STOTCK.
1143       3
1144    1306                    CALL LPC.
1145       3
1146    2206                    CALL RD.
1147    2401                    B=A1 EQV B.
1150    3707                    IF ABT SKIP ELSE STEP.
1151      23
1152    5476                    GOTO STOTCK.
1153     153                    B=6.
1154       3
1155    2146                    CALL WD.
1156       3
1157    2206                    CALL RD.
1160     111                    A2=B.                       A2=LID TO CHNG
```

```
1161      3
1162   2206                    CALL RD.
1163    115                    A3=B.                    A3=NEW FAD
1164     33                    B=TABL.
1165      3
1166   2106                    CALL PG.
1167   4301                     B=A2.
1170      3
1171   2146                    CALL WD.
1172   6301                    B=A3.
1173      3
1174   2266                    CALL WR.
1175     23
1176   5476                     GOTO STOTCK.            EXIT
                        *
                        *
                        *        *** #3 NCU READ INT MODULE ***
                        *
                       INTRD.
1177    607                    STEP.
1200    607                    STEP.
1201   3004                    DEV1=96.                 ACCESS NCU
1202     33                    B=MAIL.                  MAILBOX PG
1203      3
1204   2106                    CALL PG.
1205    113                    B=ICIE.                  WD ICIE
1206      3
1207   2146                    CALL WD.
1210   4013                    B=128.                   SET MSB
1211      3
1212   2266                    CALL WR.                 WRITE INT-READ
1213      4                    DEV1=0.                  CLEAR
1214     13                    B=WKPG.                  WORKPAGE
1215      3
1216   2106                    CALL PG.
1217   1373                    B=IQFR.                  WD IQFR
1220      3
1221   2146                    CALL WD.
1222      3
1223   2206                    CALL RD.                 GET IQFR
1224    105                    A1=B.                    A1=IQFR
1225      3
1226   2106                    CALL PG.                 PG IQFR
                       CNWMD.
1227     13                    B=ZERO.
1230      3
1231   2146                    CALL WD.
1232      3
1233   2206                    CALL RD.
1234    115                    A3=B.
1235   2533                    B=IC1.
1236   6401                    B=A3 EQV B.
1237   3707                    IF ABT SKIP ELSE STEP.
1240     63
1241    456                    GOTO NACM.
1242      3
1243   2206                    CALL RD.
1244    115                    A3=B.
1245   5253                    B=IC2.
1246   6401                    B=A3 EQV B.
```

```
1247    3707                IF ABT SKIP ELSE STEP.
1250      63
1251     456                GOTO NACM.
1252       3
1253    1306                CALL LPC.                       CK LPC
1254    2305                A1=A1.
1255    2345                BEX1 A1=A1.
1256    2401                B=A1 EQV B.
1257    3707                IF ABT SKIP ELSE STEP.
1260      63
1261     456                GOTO NACM.
1262     113                B=4.                    CK CONT DEST
1263       3
1264    2146                CALL WD.
1265       3
1266    2206                CALL RD.
1267     115                A3=B.
1270     173                B=VOLID.
1271    6401                B=A3 EQV B.             D5=VOLID?
1272    3707                 IF ABT SKIP ELSE STEP.
1273      63
1274     456                 GOTO NACM.
1275      53                B=2.
1276       3
1277    2146                CALL WD.
1300       3
1301    2206                CALL RD.
1302     161                BS=B.                   SHIFT 2 RT
1303     161                BS=B.
1304     101                B=B.                    SET COND F/FS
1305    2707                IF LST SKIP ELSE STEP.  RD ADDR ON?
1306      43
1307    6716                GOTO TOKEN.             NO
                    *      MODIFY READ ADDRESS -FAD-
1310     153                B=6.                    WD 6
1311       3
1312    2146                CALL WD.
1313       3
1314    2206                CALL RD.                GET D7
1315     111                A2=B.                    A2=D7
1316    3004                DEV1=96.                ACCESS NCU
1317      33                B=MAIL.                 MAILBOX PG
1320       3
1321    2106                CALL PG.
1322      13                B=ZERO.
1323       3
1324    2146                CALL WD.                RD ADDR WD
1325    4301                B=A2.                   B=NEW FAD=D7
1326       3
1327    2266                CALL WR.                WRITE NEW FAD
1330      20                DEV0=1.                 INT NCU
1331       4                DEV1=0.                 CLEAR
                    *        DONT WRITE TO EXEDEVICE
1332      23
1333    2036                GOTO BACK.              EXIT
                    *      MODIFY WT ADDRESS
                     TOKEN.
1334     161                BS=B.                   ROTATE 1 RT
1335     101                B=B.                    SET COND F/FS
1336    2707                IF LST SKIP ELSE STEP.  WT MOD ON?
```

```
1337      43
1340    7536                GOTO PID.                 NO
1341     153                B=6.                    GET D7
1342       3
1343    2146                CALL WD.
1344       3
1345    2206                CALL RD.
1346     111                 A2=B.                  A2=D7
1347    3004                DEV1=96.                  ACCESS NCU
1350      33                B=MAIL.                   MAILBOX PG
1351       3
1352    2106                CALL PG.
1353      53                B=2.                      WTA WD 2
1354       3
1355    2146                CALL WD.
1356    4301                B=A2.                     B=D7=NEW WTA
1357       3
1360    2266                CALL WR.                  WRT NEW WTA
1361      20                DEV0=1.                   INT NCU
1362       4                DEV1=0.                   CLEAR
                     *        DONT WRITE TO EXEDEVICE
1363      23
1364    2036                GOTO BACK.                EXIT
                     *      MOD. CONV. PG.
                      PID.
1365      20                DEV0=1.                   INT NCU
1366     161                BS=B.                     ROTATE 1 RT
1367     101                B=B.                      SET COND F/FS
1370    2707                IF LST SKIP ELSE STEP.    CONV BIT ON?
1371     103
1372    6516                GOTO INQ.                 NO, EXIT
1373     153                B=6.                    GET D7
1374       3
1375    2146                CALL WD.
1376       3
1377    2206                CALL RD.
1400     111                A2=B.                   A2=D7
1401     173                B=7.                      WD 7
1402       3
1403    2146                CALL WD.
1404       3
1405    2206                CALL RD.                  GET D8
1406     115                A3=B.                     A3=D8
1407      33                B=TABL.                   CONV TABL PG
1410       3
1411    2106                CALL PG.
1412    4301                B=A2.                     WD D7
1413       3
1414    2146                CALL WD.                  LID TO BE CHANGED
1415    6301                B=A3.                     B=D8.
1416       3
1417    2266                CALL WR.                   WRITE NEW FAD
                     *        DONT WRITE TO EXODEVICE
1420      23
1421    2036                GOTO BACK.                EXIT
                      NACM.                         NOT CONTROL
1422       4                DEV1=0.
1423      20                DEV0=1.                          INT NCU-RD
1424     103
1425    6516                GOTO INQ.                        EXIT
```

```
                        *
                        *
                        *       *** #4 NCU WRITEO INT MODULE ***
                        *
                         INTO.
1426      607                   STEP.
1427      607                   STEP.
                        *                GET WRITE ADDR
1430        4                   DEV1=0.                         CLEAR
1431       13                   B=WKPG.                         WKPG
1432        3
1433     2106                   CALL PG.
1434     1373                   B=IQFR.
1435        3
1436     2146                   CALL WD.
1437        3
1440     2206                   CALL RD.
1441      105                   A1=B.                   A1=IQFR
1442        3
1443     2106                   CALL PG.
1444      113                   B=4.
1445        3
1446     2146                   CALL WD.
1447        3
1450     2206                   CALL RD.
1451      115                   A3=B.                   A3=D5
1452       33                   B=TABL.
1453        3
1454     2106                   CALL PG.
1455     6301                   B=A3.
1456        3
1457     2146                   CALL WD.
1460        3
1461     2206                   CALL RD.
1462      115                   A3=B.                   A3=WRT ADDR
1463     3004                    DEV1=96.                       ACCESS NCU
1464       33                   B=MAIL.                        PG 1 MAILBOX
1465        3
1466     2106                   CALL PG.
1467       33                   B=WRA.
1470        3
1471     2146                   CALL WD.
1472     6301                   B=A3.
1473        3
1474     2266                   CALL WR.
1475      113                   B=ICIE.                   CIE INT WD
1476        3
1477     2146                   CALL WD.                  WD #4
1500       33                   B=ONE.
1501        3
1502     2266                   CALL WR.                  SET ICIE=1 WRTO
1503       20                   DEVO=1.                   INT NCU
1504        4                   DEV1=0.                   CLEAR
1505       13                   B=WKPG.                   PG 3
1506        3
1507     2106                   CALL PG.                  WORKPAGE
1510     1373                   B=IQFR.
1511        3
1512     2146                   CALL WD.                  IQFR
1513        3
```

```
1514    2206                CALL RD.
1515     105                A1=B.                    SAVE IQFR IN A1
1516       3
1517    2106                CALL PG.                 PG IQFR
1520      13                B=ZERO.
1521       3
1522    2146                CALL WD.
1523       3
1524    2206                CALL RD.
1525     115                A3=B.
1526    2533                B=IC1.
1527    6401                B=A3 EQV B.
1530    3707                IF ABT SKIP ELSE STEP.
1531     103
1532    6516                GOTO INQ.
1533       3
1534    2206                CALL RD.
1535     115                A3=B.
1536    5253                B=IC2.
1537    6401                B=A3 EQV B.
1540    3707                IF ABT SKIP ELSE STEP.
1541     103
1542    6516                GOTO INQ.
1543       3
1544    1306                CALL LPC.                      CK LPC
1545    2305                A1=A1.
1546    2345                BEX1 A1=A1.
1547    2401                B=A1 EQV B.
1550    3707                IF ABT SKIP ELSE STEP.
1551     103
1552    6516                GOTO INQ.
1553      53                B=2.                     WD #2
1554       3
1555    2146                CALL WD.                 GET D3
1556       3
1557    2206                CALL RD.
1560     161                BS=B.                    ROTATE 4 TIMES RT
1561     161                BS=B.
1562     161                BS=B.
1563     161                BS=B.
1564     101                B=B.                     SET COND F/FS
1565    2707                IF LST SKIP ELSE STEP.   LST ON?
1566     103
1567    6516                GOTO INQ.                NO, EXIT
                    *        CHANGE CONVERSION TABLE
1570     153                B=6.                     GET D7
1571       3
1572    2146                CALL WD.
1573       3
1574    2206                CALL RD.
1575     111                A2=B.                    A2=LID TO CHANGE
1576       3
1577    2206                CALL RD.                 GET D8
1600     115                A3=B.                    A3=NEW FAD
1601      33                B=TABL.
1602       3
1603    2106                CALL PG.                 CONVERSION TABLE
1604    4301                B=A2.                    WD=LID
1605       3
1606    2146                CALL WD.
```

```
1607    6301                B=A3.                       WRITE NEW FAD
1610       3
1611    2266                CALL WR.
                    *         DONT WRITE TO EXODEVICE
1612      23
1613    2036                GOTO BACK.                  EXIT TO BACK
                    *
                    *
                    *       *** #5 OUTPUT Q HANDLER MODULE ***
                    *
                    *         GATEWAY NODES DO NOT STORE OUTSTANDING
                    *         ACKS TO BE ACKED ON OQ.
                     OUTQ.                              OUTPUT Q MODULE
1614     607        STEP.
1615     607        STEP.
1616       4        DEV1=0.                     CLEAR
1617    6355        BEX3 A3=A3.                 GET CLK TM
1620     105        A1=B.                       A1=CLKTM
1621      13        B=WKPG.                     PUT A1 INTO
1622       3
1623    2106        CALL PG.                    LSTWT
1624    1533        B=LSTWT.                    ON WKPG
1625       3
1626    2146        CALL WD.
1627    2301        B=A1.
1630       3
1631    2266        CALL WR.
1632      53        B=BLDR.
1633       3
1634    2106        CALL PG.
1635     133        B=AKS.
1636       3
1637    2146        CALL WD.
1640       3
1641    2206        CALL RD.
1642     105        A1=B.
1643     401        B=0 EQV B.
1644    3707        IF ABT SKIP ELSE STEP.  AKS=0?
1645      63
1646    5476        GOTO MOVE.                  NO
1647    3004        DEV1=96.                            YES
1650      33        B=MAIL.
1651       3
1652    2106        CALL PG.
1653     133        B=AKS.
1654       3
1655    2146        CALL WD.
1656      13        B=ZERO.
1657       3
1660    2266        CALL WR.
1661     103
1662     536        GOTO PKT.
                    MOVE.
1663    2205        A1=A1+1.
1664     133        B=AKS.
1665       3
1666    2146          CALL WD.
1667    2301        B=A1.
1670       3
1671    2266        CALL WR.
```

```
1672     113                    B=4.                    GET AKFR
1673       3
1674    2146                    CALL WD.
1675       3
1676    2206                    CALL RD.
1677     105                    A1=B.                   A1=VAKFR
1700       3
1701    2146                    CALL WD.
1702    7773                    B=255.
1703    2605                    A1=A1-B.
1704      13                    B=ZERO.
                        LRZE.
1705       3
1706    2266                    CALL WR.                        WRT ZEROS
1707    2205                    A1=A1+1.
1710    3707                    IF ABT SKIP ELSE STEP.
1711      63
1712    6136                    GOTO LRZE.
1713    7753                    B=254.                  WD 254=EOP
1714       3
1715    2146                    CALL WD.
1716    7773                     B=EOP.
1717       3
1720    2266                    CALL WR.
1721    1521                    OUTO=0.
1722     607                    STEP.
1723    3004                    DEV1=96.
1724      33                    B=MAIL.                         MV MAIL PARS
1725       3
1726    2106                    CALL PG.
1727      13                    B=ZERO.
1730       3
1731    2146                    CALL WD.
1732       3
1733    2206                    CALL RD.
1734     105                    A1=B.
1735       3
1736    2206                    CALL RD.
1737     111                    A2=B.
1740       3
1741    2206                    CALL RD.
1742     115                    A3=B.
1743       4                    DEV1=0.
1744      53                    B=BLDR.
1745       3
1746    2106                    CALL PG.
1747      13                     B=ZERO.
1750       3
1751    2146                    CALL WD.
1752    2301                    B=A1.
1753       3
1754    2266                    CALL WR.
1755    4301                    B=A2.
1756       3
1757    2266                    CALL WR.
1760    6301                    B=A3.
1761       3
1762    2266                     CALL WR.
1763      13                    B=VINCU.
1764       3
```

```
1765    2266                CALL WR.
1766      13                B=ZERO.
1767       3
1770    2146                CALL WD.
1771    3004                DEV1=96.                    BLDR-MAIL XFER
1772      33                B=ONE.
1773       3
1774    2106                CALL PG.
1775      13                B=ZERO.
1776       3
1777    2146                CALL WD.
2000    3204                DEV1=104.
2001       3
2002    2326                CALL BLAST.
2003       4                 DEV1=0.
2004    1521                OUT0=0.
2005     607                STEP.
2006      53                B=BLDR.
2007       3
2010    2106                CALL PG.
2011      73                B=3.
2012       3
2013    2146                CALL WD.
2014     153                B=VAKCUR.
2015       3
2016    2266                CALL WR.
2017     153                B=VAKFR.                    INIT BLDR PG
2020       3
2021    2266                CALL WR.
2022      13                B=VAKS.
2023       3
2024    2266                CALL WR.
                PKT.
2025       4                DEV1=0.                     CLEAR
2026      13                B=WKPG.
2027       3
2030    2106                CALL PG.
2031    1433                B=OQNOW.
2032       3
2033    2146                CALL WD.
2034       3
2035    2206                CALL RD.
2036     401                B=0 EQV B.                  OQNOW=0?
2037    3707                IF ABT SKIP ELSE STEP.
2040     103
2041    2016                GOTO TOPQ.                  NO
                WORD2.                                   YES,Q EMPTY
2042    3004                DEV1=96.                    ACCESS NCU
2043      53                B=2.                        PG 2-OUTPUT PG
2044       3
2045    2106                CALL PG.
2046    7733                B=253.                      WD 253
2047       3
2050    2146                CALL WD.
2051      13                B=ZERO.                     =0 TO INDICATE
2052       3
2053    2266                CALL WR.                    EMPTY PAGE
2054       3
2055    2266                CALL WR.                    WD 254=0
2056      33                B=MAIL.
```

```
2057      3
2060   2106                CALL PG.
2061     53                B=WTA.
2062      3
2063   2146                CALL WD.
2064      3
2065   2206                CALL RD.
2066    105                A1=B.
2067     33                B=WRA.
2070      3
2071   2146                CALL WD.
2072   2301                 B=A1.
2073      3
2074   2266                CALL WR.
2075      4                DEV1=0.                    RETURN CIE MEM
2076    143
2077     36                GOTO INT1-2.               EXIT
                    TOPQ.
2100     13                B=WKPG.                    VALID TOP OF Q
2101      3
2102   2106                CALL PG.                   WKPG
2103    333                B=VOQTOP.                   GET OQTOP
2104    111                A2=B.                      A2=OQTOP
2105      3
2106   2106                CALL PG.
2107    113                B=4.            GET D5
2110      3
2111   2146                CALL WD.
2112      3
2113   2206                CALL RD.
2114    105                A1=B.                      A1=D5
2115     33                B=TABL.                   PG TABL
2116      3
2117   2106                CALL PG.
2120   2301                B=A1.
2121      3
2122   2146                CALL WD.                   WD D5
2123      3
2124   2206                CALL RD.
2125    115                A3=B.                      A3=FAD
2126   4301                B=A2.                      GET D3
2127      3
2130   2106                CALL PG.                   PG OQTOP
2131     53                B=2.                       WD 2
2132      3
2133   2146                CALL WD.
2134      3
2135   2206                CALL RD.
2136    161                BS=B.                      SHIFT RT
2137    161                BS=B.                      5 TMS
2140    161                BS=B.
2141    161                BS=B.
2142    161                BS=B.
2143    101                B=B.                       SET COND F/FS
2144   2707                IF LST SKIP ELSE STEP.     ALT ROUTE?
2145    103
2146   3756                GOTO NORM.                 NO
2147    103
2150   3756                GOTO NORM.                *TEMP*
2151     13                B=WKPG.                    YES,WKPG
```

```
2152      3
2153   2106                    CALL PG.                GET ALT1
2154     33                    B=ALT1.
2155      3
2156   2146                    CALL WD.
2157      3
2160   2206                    CALL RD.
2161   6415                    A3=A3 EQV B.            ALT1=FAD?
2162   3627                    IF ABT STEP ELSE SKIP.
2163    103
2164   3616                    GOTO DFFF.              YES
2165    115                    A3=B.                   NO,SET FAD=ALT1
2166    103
2167   3756                    GOTO NORM.
                       DFFF.
2170     33                    B=ALTO.                 GET ALTO
2171      3
2172   2146                    CALL WD.                SET FAD=ALTO
2173      3
2174   2206                    CALL RD.
2175    115                    A3=B.
                       NORM.
2176   3004                    DEV1=96.                ACCESS NCU
2177     33                    B=MAIL.                 MAIL PG
2200      3
2201   2106                    CALL PG.
2202     33                    B=ONE.                  WD 1
2203      3
2204   2146                    CALL WD.
2205   6301                    B=A3.                   SET WRITE ADDR
2206      3
2207   2266                    CALL WR.
2210     13                    B=RDA.                  GET RD ADDR - FAD
2211      3
2212   2146                    CALL WD.
2213      3
2214   2206                    CALL RD.
2215    105                    A1=B.                   A1=RD ADDR
2216      4                    DEV1=0.                 RTN TO CIE MEM
2217   4301                    B=A2.                   PG OQTOP
2220      3
2221   2106                    CALL PG.
2222   7733                    B=253.                  WD 253
2223      3
2224   2146                    CALL WD.
2225      3
2226   2206                    CALL RD.
2227    101                    B=B.                    SET COND F/FS
2230   3627                    IF ABT STEP ELSE SKIP.  253=EOP?
2231    103
2232   4756                    GOTO TSFR.              YES
2233   7773                    B=EOP.                  NO
2234      3
2235   2266                    CALL WR.                SET 254=EOP
                       TSFR.
                     *          CK IF BROADCAST
2236     53                    B=2.                    GET D3
2237      3
2240   2146                    CALL WD.
2241      3
```

```
2242    2206                    CALL RD.
2243     161                    BS=B.                   ROTATE 1 RT
2244     101                    B=B.                    SET COND F/FS
2245    2707                    IF LST SKIP ELSE STEP.  R/S MODE?
2246     103
2247    5556                    GOTO MVBL.              NO
2250       3
2251    2206                    CALL RD.                YES, GET D4
                        *       SET D4=RDA+128
2252    4013                    B=128.                  YES
2253    2105                    A1=A1 + B.              A1=D4.
2254      73                    B=3.
2255       3
2256    2146                    CALL WD.
2257    2301                    B=A1.
2260       3
2261    2266                    CALL WR.                WRITE D4
                        *               RECALC LPC
2262       3
2263    1306                    CALL LPC.
2264    2331                    OUT2=A1.                        WRITE LPC
2265     607                    STEP.
                        *         DO BLAST TRANSFER
                         MVBL.
2266    4301                    B=A2.                   PG OQTOP
2267       3
2270    2106                    CALL PG.                WD 0
2271      13                    B=ZERO.
2272       3
2273    2146                    CALL WD.
2274    3004                    DEV1=96.                ACCESS NCU
2275      53                    B=2.                    PG 2 - NCU
2276       3
2277    2106                    CALL PG.                WD 0
2300      13                    B=ZERO.
2301       3
2302    2146                    CALL WD.
2303    3204                    DEV1=104.               BLAST CIE-NCU
2304       3
2305    2326                    CALL BLAST.             BLAST TRANSFER
2306       4                    DEV1=0.                 CLEAR
2307    1521                    OUT0=0.
2310     607                    STEP.
2311      13                    B=WKPG.                         SET VOQNOW=0
2312       3
2313    2106                    CALL PG.
2314    1433                    B=OQNOW.
2315       3
2316    2146                    CALL WD.
2317      13                    B=ZERO.
2320       3
2321    2266                    CALL WR.
2322     143
2323      36                    GOTO INT1-2.
                        *
                        *               *** #8 CIE TO INPUT QUEUE HANDLER ***
                         INQ.
2324     607                    STEP.
2325     607                    STEP.
2326       4                    DEV1=0.
```

```
2327      13                B=WKPG.
2330       3
2331    2106                CALL PG.
2332    1373                B=IQFR.
2333       3
2334    2146                CALL WD.
2335       3
2336    2206                CALL RD.
2337     115                A3=B.                    A3=VIQFR
                    *              IF HDR HAS EOP THROW AWAY PACK
2340    6301                B=A3.
2341       3
2342    2106                 CALL PG.
2343      33                B=ONE.
2344       3
2345    2146                 CALL WD.
2346       3
2347    2206                CALL RD.                        D2
2350     101                B=B.
2351    3627                IF ABT STEP ELSE SKIP.
2352      23
2353    5476                GOTO STOTCK.
2354       3
2355    2206                CALL RD.                        D3
2356     101                B=B.
2357    3627                IF ABT STEP ELSE SKIP.
2360      23
2361    5476                GOTO STOTCK.
2362       3
2363    2206                CALL RD.                        D4
2364     101                B=B.
2365    3627                IF ABT STEP ELSE SKIP.
2366      23
2367    5476                GOTO STOTCK.
2370       3
2371    2206                 CALL RD.                       D5
2372     101                B=B.
2373    3627                IF ABT STEP ELSE SKIP.
2374      23
2375    5476                GOTO STOTCK.
2376       3
2377    2206                  CALL RD.              D6
2400     101                B=B.
2401    3627                IF ABT STEP ELSE SKIP.
2402      23
2403    5476                 GOTO STOTCK.
2404      13                B=ZERO.                  WD 0
2405     121                OUT0=B.
2406       3
2407    1306                CALL LPC.                FORM LPC IN A1
2410    2305                A1=A1.
2411    2345                BEX1 A1=A1.              GET LPC WD
2412    4607                IF LC1 STEP.             RESETS LC1
2413    2401                B=A1 EQV B.              LPC OK?
2414    3707                IF ABT SKIP ELSE STEP.
2415     123
2416     736                GOTO CSTPP.              NO
2417     201                B=1.                     YES
2420    2007                IF LST SET LC1 STEP.     SET LC1
2421     607                STEP.
```

```
2422    73              B=3.                    GET D4
2423     3
2424  2146              CALL WD.
2425     3
2426  2206               CALL RD.
2427   101               B=B.
2430   627              IF MST STEP ELSE SKIP.
2431    23
2432  2036              GOTO BACK.              DONT LINK
2433   123
2434  6776              GOTO IQLINK.
                  CSTPP.
2435   133              B=5.                    WD. 5,
2436   121              OUT0=B.
2437  2305              A1=A1.
2440  2345              BEX1 A1=A1.
2441   105              A1=B.                     A1=D6
2442    33              B=TABL.                   CONV TABL PG'
2443   125              OUT1=B.                   PG 4
2444  2321              OUT0=A1.                  WD D6
2445  2305              A1=A1.
2446  2345              BEX1 A1=A1.
2447   105              A1=B.                     A1=D0=FAD=WRT ADDR
2450  6325              OUT1=A3.                  PG IQFR
2451    53              B=2.                      WD 2
2452   121              OUT0=B.
2453  2305              A1=A1.
2454  2345              BEX1 A1=A1.               B=D3
2455   161              BS=B.                     SHIFT RT
2456   161              BS=B.                     5 TIMES
2457   161              BS=B.
2460   161              BS=B.
2461   161              BS=B.
2462   101              B=B.                      SET COND F/FS
2463  2707              IF LST SKIP ELSE STEP.    ALT ROUT USED?
2464   123
2465  2176              GOTO DO.                  N/
                  ALT.                          YES
2466    13              B=WKPG.                   PG 3
2467   125              OUT1=B.                   WORKPAGE
2470    13              B=ZERO.                   WD 0
2471   121              OUT0=B.
2472  2305              A1=A1.
2473  2345              BEX1 A1=A1.
2474   111              A2=B.                     A2=UST ROUTE
2475  2401              B=A1 EQV B.               A1=A2?
2476  3627              IF ABT STEP ELSE SKIP.
2477   123
2500  2116              GOTO OTHR.                YES
2501  4305              A1=A2.                    NO
2502   123
2503  2176              GOTO DO.                  D0=1ST ROUTE=A1
                  OTHR.
2504  2305              A1=A1.                    USE OTHER ROUTE
2505  2345              BEX1 A1=A1.               =A1
2506   105              A1=B.
                  DO.
2507    53              B=BLDR.                   PG 5
2510   125              OUT1=B.                   ACK/NAK BLDR
2511   113              B=AKFR.                   WD 4
```

```
2512     121                OUT0=B.                  AKFR
2513    2305                A1=A1.
2514    2345                BEX1 A1=A1.
2515     111                A2=B.                    A2=AKFR
2516    4321                OUT0=A2.                 WD0=AKFR
2517    2301                B=A1.                  WRITE D0 TO BLDR
2520       3
2521    2266                CALL WR.
2522    6325                OUT1=A3.                 PG IOFR
2523     133                B=5.                   WD #5
2524     121                OUT0=B.                  D6
2525    2305                A1=A1.
2526    2345                BEX1 A1=A1.
2527     105                A1=B.                    A1=D6
2530      53                B=BLDR.                   PUT D6
2531     125                OUT1=B.                  AS D5
2532    4211                A2=A2 + 1.               ON BLDR
2533     113                B=4.
2534    4121                OUT0=A2+B.                 PAGE
2535    2301                B=A1.
2536       3
2537    2266                CALL WR.
2540    6325                OUT1=A3.                 GET D5
2541     113                B=4.                   & PUT AS
2542     121                OUT0=B.                  D6 ON
2543    2305                A1=A1.                   BLDR PG
2544    2345                BEX1 A1=A1.
2545     105                A1=B.
2546      53                B=BLDR.
2547     125                OUT1=B.
2550    4211                A2=A2 + 1.
2551     113                B=4.
2552    4121                OUT0=A2+B.
2553    2301                B=A1.
2554       3
2555    2266                CALL WR.
2556    4627                IF LC1 STEP ELSE SKIP.   LPC OK?
2557     123
2560    3516                GOTO ACK.                YES, BLD ACK
2561    4013                B=128.                   NO, BLD NAK
2562     123
2563    3556                GOTO AKNK.
                    ACK.
2564     201                B=1.                       SET LC1
2565    2007                IF LST SET LC1 STEP.
                    AKNK.
2566    4211                A2=A2 + 1.               WRT D3=B
2567    4321                OUT0=A2.
2570       3
2571    2266                CALL WR.
2572    4211                A2=A2+1.               SET D4=0
2573      13                B=ZERO.
2574       3
2575    2266                CALL WR.
2576    6325                OUT1=A3.                   MOVE D1
2577      13                B=ZERO.
2600     121                OUT0=B.
2601    2305                A1=A1.
2602    2345                BEX1 A1=A1.
2603     105                A1=B.
```

```
2604      53                B=BLDR.
2605     125                OUT1=B.
2606    4211                A2=A2 + 1.
2607     113                B=4.
2610    4621                OUT0=A2-B.
2611    2301                B=A1.
2612       3
2613    2266                 CALL WR.
2614    6325                OUT1=A3;                    MOVE D2
2615      33                B=ONE.
2616     121                OUT0=B.
2617    2305                A1=A1.
2620    2345                BEX1 A1=A1.
2621     105                A1=B.
2622      53                B=BLDR.
2623     125                OUT1=B.
2624    4211                A2=A2 + 1.
2625     113                B=4.
2626    4621                OUT0=A2-B.
2627    2301                B=A1.
2630       3
2631    2266                CALL WR.
2632    7773                B=EOP.                      FORM D7=EOP
2633    4211                A2=A2 + 1.
2634    4321                OUT0=A2.
2635       3
2636    2266                CALL WR.
2637    1505                A1=0.                       INIT LPC
2640     113                B=AKFR.                     GET AKFR
2641     121                OUT0=B.
2642    2305                A1=A1.
2643    2345                BEX1 A1=A1.
2644       1                B=B+1.
2645     121                OUT0=B.                     WD=AKFR+1
2646     153                B=6.
2647     115                 A3=B.
                    ALPCK.
2650    2305                A1=A1.
2651    2345                BEX1 A1=A1.
2652    2505                A1=A1 XOR B.
2653    6215                A3=A3+1.
2654    3627                IF ABT STEP ELSE SKIP.
2655     123
2656    5576                GOTO NOAEOP.
2657     111                A2=B.
2660    7773                B=EOP.
2661    4411                A2=A2 EQV B.
2662    3707                IF ABT SKIP ELSE STEP.
2663     123
2664    5216                GOTO ALPCK.
2665     123
2666    6116                GOTO SUCEOP.
                    NOAEOP.
2667     113                B=AKFR.
2670       3
2671    2146                CALL WD.
2672       3
2673    2206                CALL RD.
2674     111                A2=B.
2675     173                B=7.
```

```
2676    4101                B=A2+B.
2677       3
2700    2146                CALL WD.
2701    7773                B=EOP.
2702       3
2703    2266                CALL WR.
                         SUCEOP.
2704    2301                 B=A1.                  WRITE LPC
2705       3
2706    2266                CALL WR.
2707     113                B=AKFR.                  GET AKFR
2710     121                OUT0=B.                  PUT INTO A1
2711    2305                A1=A1.
2712    2345                BEX1 A1=A1.
2713     105                A1=B.
2714     233                B=9.                     ADD 9
2715    2105                A1=A1 + B.
2716     113                B=AKFR.                  UPDATE AKFR
2717     121                OUT0=B.
2720    2301                B=A1.
2721       3
2722    2266                CALL WR.
2723     133                B=AKS.                   UPDATE AKS
2724     121                OUT0=B.
2725    4004                DEV1=128.                DISABLE AUTOINCR
2726    2305                A1=A1.
2727    2345                BEX1 A1=A1.
2730       1                B=B + 1.                 ONE MORE ACK/NAK
2731       3
2732    2266                CALL WR.
2733       4                DEV1=0.                  CLEAR
2734    4707                IF LC1 SKIP ELSE STEP.   DID LPC CK?
2735      23
2736    5476                GOTO STOTCK.               NO,DONT LINK PACKETT
                         *    CRT CONNECTED CIE MUST STRIP
                         *    OFF PROTOCOL CHARACTERS
                         IQLINK.
2737      13                B=WKPG.                  YES,LINK TO IQ
2740     125                OUT1=B.                  UPDATE CURR Q SIZE
2741    1333                B=IQNOW.                 IQNOW
2742     121                OUT0=B.
2743    4004                DEV1=128.                DISABLE AUTOINCR
2744    2305                A1=A1.
2745    2345                BEX1 A1=A1.
2746       1                B=B + 1.                 INC
2747       3
2750    2266                CALL WR.
2751    1373                B=IQFR.                  UPDATE IQFR
2752     121                OUT0=B.
2753    2305                A1=A1.
2754    2345                BEX1 A1=A1.
2755       1                B=B + 1.                 INC
2756     105                A1=B.                    CHECK FOR
2757     253                B=VIQMAX.                 WRAPAROUND
2760     111                A2=B.                    A2=IQMAX
2761      73                B=3.
2762    4111                A2=A2 + B.               PT INTO Q
2763    2301                B=A1.                    A1=NEW IQFR
2764    4411                A2=A2 EQV B.             A1=A2?
2765    3627                IF ABT STEP ELSE SKIP.
```

```
2766      73                B=3.                        YES,RESET IQFR
2767     607                STEP.
2770     105                A1=B.
2771    1373                B=IQFR.                     WD IQFR
2772     121                OUT0=B.
2773    2301                B=A1.
2774       3
2775    2266                CALL WR.                 WRT TO MEM
2776       4                DEV1=0.                    CLEAR
2777      23
3000    5476                GOTO STOTCK.                 EXIT
                    *
                    *        *** #7 NCU INT1,2 MODULE ***
                     INT1-2.
3001     607                STEP.
3002     607                STEP.
3003    3004                DEV1=96.                    ACCESS NCU
3004      33                B=MAIL.                     MAILBOX PG
3005       3
3006    2106                CALL PG.
3007     113                B=ICIE.                     CIE INT WD
3010       3
3011    2146                CALL WD.
3012      13                B=ZERO.                     SET=0
3013       3
3014    2266                CALL WR.                    WRITE1,2
3015      20                DEV0=1.                     INT NCU
                    *          SET BEGWD FOR WT TIMEOUTS
3016       4                DEV1=0.                     ACCESS CIE MEM
3017      13                B=WKPG.                     WORKPAGE
3020       3
3021    2106                CALL PG.
3022    1613                B=BEGWD.                    BEGWD
3023       3
3024    2146                CALL WD.
3025      33                B=ONE.                      SET BEGWD
3026       3
3027    2266                CALL WR.
3030      23
3031    5476                GOTO STOTCK.
                    *
                    *        *** #8 EXT TO CIE MODULE ***
                    *
                    *          WHEN GATEWAY NODES FIND ACKS/NAKS FROM EXO,
                    *          THEY ARE MOVED DIRECTLY TO BLDR PG
                    *          AND NOT LINKED TO OQ.
                     EXXCIE.
3032     607                STEP.
3033     607                STEP.
3034       4                DEV1=0.                     CLEAR
3035      13                B=WKPG.
3036       3
3037    2106                CALL PG.                    WORKPAGE
3040    1433                B=OQNOW.
3041       3
3042    2146                CALL WD.
3043       3
3044    2206                CALL RD.
3045     401                B=0 EQV B.
3046    3707                IF ABT SKIP ELSE STEP.
```

```
3047     23
3050   5476                GOTO STOTCK.
3051    333                B=VOQTOP.
3052    105                A1=B.                    A1=VOQTOP
3053      4                DEV1=0.
3054   4351                BEX2 A2=A2.
3055    333                B=VOQTOP.
3056    125                OUT1=B.
3057   1521                OUT0=0.
3060    607                STEP.
3061     44                DEV1=2.                  BLAST EXO-CIE
3062      3
3063   2326                CALL BLAST.              BLAST MOVE
3064     24                DEV1=1.                  TERMINATE BLAST
3065    607                STEP.
3066   4351                  BEX2 A2=A2.
3067      4                DEV1=0.                  CLEAR
3070   1521                OUT0=0.
3071    607                STEP.
3072     53                B=2.                  GET D3
3073      3
3074   2146                CALL WD.
3075      3
3076   2206                CALL RD.
3077    101                B=B.
3100   2627                IF LST STEP ELSE SKIP. =ACK?
3101    143
3102   7456                 GOTO JHDAKQ.          YES
3103    101                B=B.
3104    627                IF MST STEP ELSE SKIP. =NAK?
3105    143
3106   7456                GOTO JHDAKQ.          YES
                     *            CK IF CONTROL PACKET
3107     13                B=ZERO.
3110      3
3111   2146                CALL WD.
3112      3
3113   2206                CALL RD.
3114    115                A3=B.
3115   2533                B=IC1.
3116   6401                B=A3 EQV B.
3117   3707                IF ABT SKIP ELSE STEP.
3120    143
3121   7156                GOTO LNKOQ.
3122      3
3123   2206                CALL RD.
3124    115                A3=B.
3125   5253                 B=IC2.
3126   6401                B=A3 EQV B.
3127   3707                 IF ABT SKIP ELSE STEP.
3130    143
3131   7156                GOTO LNKOQ.
3132    113                 B=4.                 CK D5
3133      3
3134   2146                CALL WD.
3135      3
3136   2206                CALL RD.
3137    115                A3=B.
3140    173                B=VOLID.
3141   6401                B=A3 EQV B.
```

```
3142    3707                    IF ABT SKIP ELSE STEP.
3143     143
3144    7156                    GOTO LNKOQ.
3145      53                    B=2.                        GET D3
3146       3
3147    2146                    CALL WD.
3150       3
3151    2206                    CALL RD.
3152     161                    BS=B.
3153     161                    BS=B.
3154     101                    B=B.
3155    2707                    IF LST SKIP ELSE STEP.
3156     143
3157    4456                    GOTO XTOK.
3160      20                    DEV0=1.
3161      34                    DEV3=1.
3162       3
3163     766                    CALL WT7MS.
3164       3
3165     766                    CALL WT7MS.
3166     335                     OUT3 AMPCR=AMPCR.
3167     335                    OUT3 AMPCR=AMPCR.
3170     153                     B=6.
3171       3
3172    2146                    CALL WD.
3173       3
3174    2206                    CALL RD.
3175     111                    A2=B.
3176    3004                    DEV1=96.
3177      33                    B=MAIL.
3200       3
3201    2106                    CALL PG.
3202      13                    B=ZERO.
3203       3
3204    2146                    CALL WD.
3205    4301                    B=A2.
3206       3
3207    2266                    CALL WR.
3210     113                     B=ICIE.
3211       3
3212    2146                    CALL WD.
3213    4013                    B=128.
3214       3
3215    2266                    CALL WR.
3216       4                    DEV1=0.
3217      20                    DEV0=1.
3220      23
3221    2036                     GOTO BACK.
                        XTOK.
3222     161                    BS=B.
3223     101                    B=B.
3224    2707                    IF LST SKIP ELSE STEP.
3225     143
3226    5636                    GOTO XCNV.
3227      20                    DEV0=1.
3230      34                    DEV3=1.
3231       3
3232     766                    CALL WT7MS.
3233       3
3234     766                    CALL WT7MS.
```

```
3235    335                 OUT3 AMPCR=AMPCR.
3236    335                 OUT3 AMPCR=AMPCR.
3237    153                 B=6.
3240      3
3241   2146                 CALL WD.
3242      3
3243   2206                 CALL RD.
3244    111                 A2=B.
3245   3004                 DEV1=96.
3246     33                 B=MAIL.
3247      3
3250   2106                 CALL PG.
3251     53                 B=2.
3252      3
3253   2146                 CALL WD.
3254   4301                 B=A2.
3255      3
3256   2266                 CALL WR.
3257    113                 B=ICIE.
3260      3
3261   2146                 CALL WD.
3262   4013                 B=128.
3263      3
3264   2266                 CALL WR.
3265     20                 DEV0=1.
3266      4                 DEV1=0.
3267     23
3270   2036                 GOTO BACK.
                    XCNV.
3271    161                 BS=B.
3272    101                 B=B.
3273   2707                 IF LST SKIP ELSE STEP.
3274     23
3275   2036                 GOTO BACK.
3276     20                 DEV0=1.
3277     34                 DEV3=1.
3300      3
3301    766                 CALL WT7MS.
3302      3
3303    766                 CALL WT7MS.
3304    335                 OUT3 AMPCR=AMPCR.
3305    335                  OUT3 AMPCR=AMPCR.
3306    153                 B=6.
3307      3
3310   2146                 CALL WD.
3311      3
3312   2206                 CALL RD.
3313    111                 A2=B.                    A2=LID TO CHNG
3314      3
3315   2206                 CALL RD.
3316    115                 A3=B.                    A3=NEW FAD
3317     33                 B=TABL.
3320      3
3321   2106                 CALL PG.
3322   4301                 B=A2.
3323      3
3324   2146                 CALL WD.
3325   6301                 B=A3.
3326      3
3327   2266                  CALL WR.
```

```
3330    3004                    DEV1=96.
3331      33                    B=MAIL.
3332       3
3333    2106                    CALL PG.
3334     113                    B=ICIE.
3335       3
3336    2146                    CALL WD.
3337    4013                     B=128.
3340       3
3341    2266                    CALL WR.
3342      20                    DEV0=1.
3343       4                    DEV1=0.
3344      23
3345    2036                    GOTO BACK.
                        LNKOQ.
3346      13                    B=WKPG.                         NO.LINK TO OQ
3347       3
3350    2106                    CALL PG.
3351    1433                    B=OQNOW.
3352       3
3353    2146                    CALL WD.
3354      33                    B=ONE.
3355       3
3356    2266                    CALL WR.
3357       4                    DEV1=0.
3360      23
3361    5476                    GOTO STOTCK.            EXIT
                        *               ROUTINE TO MOVE AN ACK/NAK
                        *               FROM OQTOP TO BLDR PG
                         JHDAKQ.
3362     113                    B=4.                    GET DO FR D5
3363       3
3364    2146                    CALL WD.
3365       3
3366    2206                    CALL RD.
3367     111                    A2=B.                   A2=D5
3370      33                    B=TABL.
3371       3
3372    2106                    CALL PG.
3373    4301                    B=A2.
3374       3
3375    2146                    CALL WD.
3376       3
3377    2206                    CALL RD.
3400     111                    A2=B.                   A2=WRT ADDR
3401      53                     B=BLDR.
3402       3
3403    2106                    CALL PG.
3404     113                    B=AKFR.
3405       3
3406    2146                    CALL WD.
3407       3
3410    2206                    CALL RD.
3411     115                    A3=B.                   A3=LOC ON BLDR
3412       3
3413    2146                    CALL WD.
3414    4301                    B=A2.                   SET DO
3415       3
3416    2266                    CALL WR.
3417     333                    B=VOQTOP.
```

```
3420        3
3421     2106                    CALL PG.
                        *                MOVE AKS TO BLDR
3422       13                    B=ZERO.
3423        3
3424      446                    CALL AKMVR.            MOVE D1
3425       33                    B=ONE.
3426        3
3427      446                    CALL AKMVR.            D2
3430       53                    B=2.
3431        3
3432      446                     CALL AKMVR.           D3
3433       73                    B=3.
3434        3
3435      446                    CALL AKMVR.            D4
3436      113                    B=4.
3437        3
3440      446                    CALL AKMVR.            D5
3441      133                    B=5.
3442        3
3443      446                    CALL AKMVR.            D6
3444      153                    B=6.
3445        3
3446      446                    CALL AKMVR.            D7
3447      173                    B=7.
3450        3
3451      446                    CALL AKMVR.            D8
3452       53                    B=BLDR.                        UPDATE BLDR
3453        3
3454     2106                    CALL PG.
3455      113                    B=AKFR.
3456        3
3457     2146                     CALL WD.
3460     6201                    B=A3+1.
3461        3
3462     2266                    CALL WR.
3463      133                    B=AKS.
3464        3
3465     2146                    CALL WD.
3466        3
3467     2206                    CALL RD.
3470       15                    A3=B+1.
3471      133                     B=AKS.
3472        3
3473     2146                    CALL WD.
3474     6301                    B=A3.
3475        3
3476     2266                    CALL WR.
3477        4                    DEV1=0.
3500       23
3501     5476                    GOTO STOTCK.           EXIT
                                 END?.
THE NUMBER OF ERRORS= 0
TTO  --  STOP
>
```

```
 RUN [20,20]MDMPL
PLEASE ENTER INPUT SOURCE FILE NAME
HST9.DAT
PLEASE ENTER OUTPUT OBJECT FILE NAME
HST9.OBJ
WAIT FOR FIRST PASS - SCAN FOR LABELS
  250 RECORDS READ
  500 RECORDS READ
  750 RECORDS READ
 1000 RECORDS READ
 1250 RECORDS READ
 1500 RECORDS READ
MPAD     CODE

                        $12BIT
                         PROGRAM-ID CIE.
                        *
                        *   **** CIE NODAL SOFTWARE ****
                        *
                         WKPG VALUE 0.
                         IQFR VALUE 47.
                         TABL VALUE 1.
                         AKFR VALUE 4.
                         BLDR VALUE 2.
                         IQNOW VALUE 45.
                         AKS VALUE 5.
                         IQMAX VALUE 44.
                         MAIL VALUE 1.
                         ICIE VALUE 4.
                         ZERO VALUE 0.
                         ONE VALUE 1.
                         EOP VALUE 255.
                         RDA VALUE 0.
                         WRA VALUE 1.
                         WTA VALUE 2.
                         INCU VALUE 3.
                         AKS VALUE 5.
                         ALT1 VALUE 0.
                         OQNOW VALUE 49.
                         OQTOP VALUE 50.
                         OQFR VALUE 51.
                         IQTOP VALUE 46.
                         BEGWD VALUE 56.
                         LSTWT VALUE 53.
                         DFFWT VALUE 54.
                         OQMAX VALUE 48.
                         D3 VALUE 2.
                         AKCUR VALUE 3.
                         LOOPNO VALUE 253.
                         SYSNO VALUE 254.
                         OLID VALUE 149.
                         MSGNO VALUE 152.
ER                       COUNT VALUE 180.                    BLAST TIMING PARAMET
                           VLOOPNO VALUE 4.
                         VSYSNO VALUE 11.
                         VAKCUR VALUE 6.
                         VRDA VALUE 3.
                         VWRA VALUE 2.
                         VWTA VALUE 2.
                         VINCU VALUE 0.
```

```
                        VAKS VALUE 0.
                        VAKFR VALUE 6.
                        VALT1 VALUE 1.
                        VALT0 VALUE 2.
                        VIQMAX VALUE 8.
                        VIQNOW VALUE 0.
                        VIQTOP VALUE 3.
                        VIQFR VALUE 3.
                        VOQMAX VALUE 1.
                        VOQNOW VALUE 0.
                        VOQTOP VALUE 11.
                        VOQFR VALUE 0.
                        VDFFWT VALUE 14.              #TICKS
                        VMAXTR VALUE 2.
                        VMAXCK VALUE 41.              #TICKS
                        VICIE VALUE 128.
                        VOLID VALUE 9.
                        VPDDLID VALUE 5.
                        VADDLID VALUE 1.
                        IC1 VALUE 85.
                        IC2 VALUE 170.                FOR CONT PACK
                        CR VALUE 232.
                        CONU VALUE 169.
0         3
1      3016             GOTO INIT.
2        23
3      1556             GOTO BACK.                    HDWR ERR
                    *          DEBUG JUMPS
4        43
5       476             GOTO CONT.
6        43
7      3116             GOTO INTRD.
10       63
11       76             GOTO INT0.
12       63
13     3636             GOTO OUTQ.
14      103
15     4676             GOTO OUTAK.
16      123
17     1776             GOTO INQ.
20      143
21     3076             GOTO INT1-2.
22      143
23     3716             GOTO EXXCIE.
                    *          LK AT OUTPUT BUF SUB
                     LKOTB.
24     1515             A3=0.                         INIT TM PAR
                     OTBL.
25       13             B=ZERO.
26      141             BEX0 B=B.                             GET BUF ST REG
27      101             B=B.
30     2627             IF LST STEP ELSE SKIP.        OUT BUF FULL?
31      657             JUMP.                         EXIT
32      607             STEP.
33     6215             A3=A3+1.
34     3707             IF ABT SKIP ELSE STEP.        2 MSEC TMOUT?
35        3
36      536             GOTO OTBL.                    NO
37      657             JUMP.                         YES, ERROR COND
                    *          LK AT INPUT BUF SUB
```

```
                    LKINB.
40      1515                A3=0.
                    INBL.
41        13                B=ZERO.
42       141                BEX0 B=B.                          GET BUF ST REG
43       101                B=B.
44       627                IF MST STEP ELSE SKIP.  INPUT BUF EMPTY?
45       657                JUMP.                   EXIT
46       607                 STEP.
47      6215                A3=A3+1.                           INCR TM PAR
50      3707                IF ABT SKIP ELSE STEP.  2 MSEC TMOUT?
51         3
52      1036                GOTO INBL.              NO
53       657                JUMP.                   YES,ERROR COND
                    *               7 MSEC WAIT SUB.
                    WT7MS.
54      7613                B=248.
55       105                A1=B.
56     .1511                A2=0.
                    INLP1.
57      4211                A2=A2+1.
60      3707                IF ABT SKIP ELSE STEP.
61         3
62      1376                GOTO INLP1.
63      1511                A2=0.
64      2205                A1=A1+1.
65      3707                IF ABT SKIP ELSE STEP.
66         3
67      1376                GOTO INLP1.
70       657                JUMP.
                    *       SUBROUTINES LPC,LKFR,LKTOP,REBLDR,WRMAIL,
                    *          SUBROUTINE TO PUT LPC IN A1
                    LPC.
                    *                ELIMINATE HANGS
71         4                DEV1=0.
72      7733                B=253.
73       121                OUT0=B.
74      2305                A1=A1.
75      2345                BEX1 A1=A1.
76       101                 B=B.
77      3627                IF ABT STEP ELSE SKIP.
100        3
101     2176                GOTO LPCINIT.
102     7753                B=254.
103      121                OUT0=B.
104     7773                B=255.
105      131                OUT2=B.
106      607                STEP.
                    LPCINIT.
107     1521                OUT0=0.
110     1505                A1=0.
                    LPCILP.
111     2305                A1=A1.                             GET WD
112     2345                BEX1 A1=A1.
113    .2505                A1=A1 XOR B.                       XOR
114      101                B=B.                               SET COND F/FS
115     3707                IF ABT SKIP ELSE STEP.             STOP IF EOP
116        3
117     2216                GOTO LPCILP.
120      657                JUMP.
```

```
                                *
                                *       PAGE SET, WORD SET,
                                *       READ, WRITE MEMORY SUBROUTINES
                                PG.                             PAGE SET SUB
121      125                            OUT1=B.                 PAGE IN B REG
122      657                            JUMP.                   RETURN
                                WD.                             WORD SET SUB
123      121                            OUT0=B.                 WORD LOC IN B
124      657                            JUMP.                   RETURN
                                RD.                             READ FR MEM SUB
125     2305                            A1=A1.                  PROVIDE 10 CLOCKS
126     2345                            BEX1 A1=A1.             RD INTO B REG
127      657                            JUMP.                   RETURN
                                WR.                             WRITE FR MEM SUB
130      131                            OUT2=B.                 FROM B
131      657                            JUMP.                   RETURN
                                *
                                *       BLAST TRANSFER SUBROUTINE
                                BLAST.
132     5513                            B=COUNT.                SET CTR
                                AGAIN.
133        1                            B=B + 1.
134     3707                            IF ABT SKIP ELSE STEP.  TEST CTR
135        3
136     2676                            GOTO AGAIN.                NO
137      657                            JUMP..                  YES, RETURN
                                *
                                INIT.
140      335                            OUT3 AMPCR=AMPCR.
141      335                            OUT3 AMPCR=AMPCR.       ACCESS NCU MEM
142        3
143     1306                            CALL WT7MS.             GIVE NCU TM
144        3
145     1306                            CALL WT7MS.
146      104                            DEV1=4.                 INIT CRT
147        4                            DEV1=0.
150     1521                            OUT0=0.
151      607                            STEP.
152     3004                            DEV1=96.
153       33                            B=MAIL.
154        3
155     2426                            CALL PG.
156       13                            B=RDA.
157        3
160     2466                            CALL WD.
161       73                            B=VRDA.
162        3
163     2606                            CALL WR.
164       53                            B=VWRA.
165        3
166     2606                            CALL WR.
167       53                            B=VWTA.
170        3
171     2606                            CALL WR.
172       13                            B=VINCU.
173        3
174     2606                            CALL WR.
175     4013                            B=VICIE.
176        3
177     2606                            CALL WR.
```

```
200      13                    B=VAKS.
201       3
202    2606                    CALL WR.
203    7773                    B=255.
204     121                    OUT0=B.
205       3
206    2606                    CALL WR.
207    1525                    OUT1=0.
210     121                     OUT0=B.
211       3
212    2606                    CALL WR.
213    1521                    OUT0=0.
214     607                    STEP.
                    *           LOAD WORKPAGE
215       4                    DEV1=0.                    CIE MEM
216      13                    B=WKPG.
217       3
220    2426                    CALL PG.
221      13                    B=ALT1.
222       3
223    2466                    CALL WD.
224      33                    B=VALT1.
225       3
226    2606                    CALL WR.
227      53                    B=VALT0.
230       3
231    2606                    CALL WR.
232    7773                    B=255.                     LOC 2-43
233     105                    A1=B.                      =0
234    1253                    B=42.
235    2605                    A1=A1 - B.
                    *           A1=COUNTER
                  INRP1.
236      13                    B=ZERO.
237       3
240    2606                    CALL WR.
241    2205                    A1=A1 + 1.
242    3707                    IF ABT SKIP ELSE STEP.
243       3
244    4756                    GOTO INRP1.
245    1313                    B=IQMAX.
246     121                    OUT0=B.
247     213                    B=VIQMAX.
250       3
251    2606                    CALL WR.
252      13                    B=VIQNOW.
253       3
254    2606                    CALL WR.
255      73                    B=VIQTOP.
256       3
257    2606                    CALL WR.
260      73                    B=VIQFR.
261       3
262    2606                    CALL WR.
263      33                    B=VOQMAX.
264       3
265    2606                    CALL WR.
266      13                    B=VOQNOW.
267       3
270    2606                    CALL WR.
```

```
271      273                    B=VOQTOP.
272        3
273     2606                    CALL WR.
274       13                    B=VOQFR.
275        3
276     2606                    CALL WR.
277       13                     B=ZERO.
300        3
301     2606                    CALL WR.
302        3
303     2606                    CALL WR.
304     1553                    B=DFFWT.
305      121                    OUT0=B.
306      353                    B=VDFFWT.                    LOC 54
307        3
310     2606                    CALL WR.
311     2713                    B=92.                        LOC 55-146
312     2605                    A1=A1 - B.                   =0
                        INRP3.
313       13                    B=ZERO.
314        3
315     2606                    CALL WR.
316     2205                    A1=A1 + 1.
317     3707                    IF ABT SKIP ELSE STEP.
320        3
321     6276                    GOTO INRP3.
322     1613                    B=BEGWD.
323      121                    OUT0=B:
324     1531                    OUT2=0.                  BEG WD NOT INIT SET
                          *      1 NODE ON EACH LOOP
                          *      WILL HAVE ITS BEGWD INITIALLY ON
                          *      TO GENERATE THE 1ST WT
ADDLID                    *       CRT NODE USES, LOCS.  149,150,151 OLID,PDDLID,
        325     4533              B=OLID.
326        3
327     2466                    CALL WD.
330      233                    B=VOLID.
331        3
332     2606                    CALL WR.
333      133                    B=VPDDLID.
334        3
335     2606                    CALL WR.
336       33                    B=VADDLID.
337        3
340     2606                    CALL WR.
341     3013                    B=96.                        LOC 152-247
342     2605                    A1=A1 - B.                   =0
                        INRP4.
343       13                    B=ZERO.
344        3
345     2606                    CALL WR.
346     2205                    A1=A1 + 1.
347     3707                    IF ABT SKIP ELSE STEP.
350        3
351     7076                    GOTO INRP4.
352     4673                    B=155.
353      121                    OUT0=B.
354      153                    B=6.
355      131                    OUT2=B.
356      607                    STEP.
```

```
357     7733                    B=LOOPNO.
360        3
361     2466                    CALL WD.
362      113                    B=VLOOPNO.
363        3
364     2606                    CALL WR.
365      273                    B=VSYSNO.
366        3
367     2606                    CALL WR.
                        *        LOAD CONVERSION PG
                        *        SPECIAL LIDS MAY ALSO
                        *        BE LOADED AT A LATER TIME
370       33                    B=TABL.
371        3
372     2426                    CALL PG.
373       13                    B=ZERO.
374        3
375     2466                    CALL WD.
376      105                    A1=B.
377       13.                   B=ZERO.                 SND TO FAD 0
                      INRP5.
400        3
401     2606                    CALL WR.
402     2205                    A1=A1 + 1.
403     3707                    IF ABT SKIP ELSE STEP.
404       23
405       16                    GOTO INRP5.
406       33                    B=ONE.
407        3
410     2466                    CALL WD.
411        3
412     2606                    CALL WR.
413      113                    B=4.
414        3
415     2466                    CALL WD.
416        3
417     2606                     CALL WR.
420       53                    B=2.
421        3
422     2606                    CALL WR.
423      213                    B=8.
424        3
425     2466                    CALL WD.
426       73                    B=3.
427        3
430     2606                    CALL WR.
431     3773                    B=127.                  CRT BRDCST
432        3
433     2466                    CALL WD.
434       53                    B=VWTA.
435        3
436     2606                    CALL WR.
437     7753                    B=254.
440        3
441     2466                    CALL WD.                        SYST BROADCST
442       53                    B=VWTA.
443        3
444     2606                    CALL WR.
                        *        LOAD ACK/NAK BUILDER PG
445       53                    B=BLDR.
```

```
446       3
447    2426                    CALL PG.
450      73                    B=3.
451       3
452    2466                    CALL WD.
453     153                    B=VAKCUR.
454       3
455    2606                    CALL WR.
456     153                    B=VAKFR.
457       3
460    2606                    CALL WR.
461      13                    B=VAKS.
462       3
463    2606                    CALL WR.
                     *          DATA MEM IS NOW INITIALIZED
                     *          SET NCU EXT TO FORCE IT
                     *          TO THE READ STATE
464    5607                    IF LC2 STEP.            RESET LC2
465      20                    DEV0=1.                   INT NCU
                     *
                     *          *** #1 BACKGROUND MODULE ***
                     *
                      BACK.
466     607                    STEP.
467     607                    STEP.
470       4                    DEV1=0.                   CLEAR
471      13                    B=WKPG.                   WORKPAGE
472       3
473    2426                    CALL PG.
474    7627                    IF EXT STEP ELSE SKIP.    INT PRES:
475      43
476     476                    GOTO CONT.               EXIT #2
477      13                    B=ZERO.
500     141                    BEX0 B=B.                 GET STATUS BUF REG
501     101                    B=B.                      SET COND F/FS
502    2627                    IF LST STEP ELSE SKIP.   OUT BUF FULL?
503     143
504    3716                    GOTO EXXCIE.               YES
505     101                    B=B.
506     707                    IF MST SKIP ELSE STEP.    IN BUF EMPTY?
507      23
510    5616                    GOTO WTTM.                NO
511    1333                    B=IQNOW.                  YES
512       3
513    2466                    CALL WD.                  GET CURRENT
514       3
515    2526                    CALL RD.                  IQ SIZE
516     401                    B=0 EQV B.                =0?
517    3627                    IF ABT STEP ELSE SKIP.
520      23
521    5616                    GOTO WTTM.                YES
                     *          NO-BLAST TRANSFER CONTENTS ON
                     *          PG IQTOP TO INPUT BUFFER
522    1353                    B=IQTOP.                  GET IQTOP VALUE
523       3
524    2466                    CALL WD.
525       3
526    2526                    CALL RD.
527     105                    A1=B.                     SAVE A1=IQTOP
530       3
```

```
531     2426                    CALL PG.                    PG IQTOP
532     1521                    OUT0=0.
533      607                      STEP.
                        *               CIE TO CRT SND ROUTINE
                        *               A1=PG #, A2=WD #
                        *               IF LC2 ON-CONT AS BEFORE NCU INT
                        *               IF LC2 OFF-SND ENQ
534     5627                    IF LC2 STEP ELSE SKIP.  LC2 ON?
535       23
536     3076                    GOTO MIDMES.            YES,MID OF MSG
537      153                    B=6.
540      111                    A2=B.
541       23
542     3356                    GOTO CIECRT.
                        MIDMES.
543        4                    DEV1=0.
544       13                    B=WKPG.
545      125                    OUT1=B.
546     4633                    B=153.
547      121                    OUT0=B.
550     2305                    A1=A1.
551     2345                     BEX1 A1=A1.
552      105                     A1=B.
553     2305                    A1=A1.
554     2345                    BEX1 A1=A1.
555      111                    A2=B.
                        CIECRT.
556     4004                    DEV1=128.
557     2325                    OUT1=A1.
560     4321                    OUT0=A2.
561     2305                    A1=A1.
562     2345                    BEX1 A1=A1.
563      115                    A3=B.
564     7773                    B=EOP.
565     6415                    A3=A3 EQV B.            =EOP?
566     3627                    IF ABT STEP ELSE SKIP.
567       23
570     4316                    GOTO IQLNKT.
571     4004                    DEV1=128.                       NO, SND CHAR
572     2325                    OUT1=A1.
573     4321                    OUT0=A2.
574     4104                    DEV1=132.
575     4004                    DEV1=128.
576        4                    DEV1=0.
577       13                    B=WKPG.
600      125                    OUT1=B.
601     4633                    B=153.
602      121                    OUT0=B.
603     2331                    OUT2=A1.
604      607                    STEP.
605     4211                    A2=A2+1.
606     4331                    OUT2=A2.
607      607                    STEP.
610      201                    B=1.
611     2207                    IF LST SET LC2 STEP.    SET LC2
612       23
613     1556                    GOTO BACK.
                        IQLNKT.
614     5607                    IF LC2 STEP.            RESET LC2
615        4                    DEV1=0.                   CLEAR
```

```
616      13                  B=WKPG.                    WORKPAGE
617       3
620    2426                  CALL PG.
621    1333                  B=IQNOW.                   GET IQNOW
622       3
623    2466                  CALL WD.
624       3
625    2526                  CALL RD.
626     105                  A1=B.            DECR IQNOW
627      33                  B=ONE.
630    2205                  A1=A1+1.
631    2705                  A1=A1-B-1.
632    1333                   B=IQNOW.
633       3
634    2466                  CALL WD.
635    2301                  B=A1.
636       3
637    2606                  CALL WR.
640    1353                  B=IQTOP.                   GET IQTOP
641       3
642    2466                  CALL WD.
643       3
644    2526                  CALL RD.
645       1                  B=B + 1.                   INCR IQTOP
646     105                  A1=B.                      A1=NEW IQTOP
647     213                  B=VIQMAX.                   GET IQMAX
650     111                  A2=B.                      A2=IQMAX
651      73                  B=3.
652    4101                  B=A2 + B.                  B=IQMAX+ 3
653    2415                  A3=A1 EQV B.               IQTOP=B?
654    3707                  IF ABT SKIP ELSE STEP.
655      23
656    5436                  GOTO WRIQT.                NO
657      73                  B=3.                       YES, WRAPAROUND
660     105                  A1=B.
                    WRIQT.
661    1353                  B=IQTOP.                   WRITE IQTOP
662       3
663    2466                  CALL WD.
664    2301                  B=A1.
665       3
666    2606                  CALL WR.
667       4                  DEV1=0.                    ENABLE MAR INCR
                    *          LOOK FOR TIMEOUTS TO
                    *          GENERATE NEW WTS
                     WTTM.
670    7627                  IF EXT STEP ELSE SKIP.     INT PRES:
671      43
672     476                  GOTO CONT.                EXIT
673      13                  B=ZERO.
674     141                  BEX0 B=B.                  GET STATUS BUF REG
675     101                  B=B.                       SET COND F/FS
676    2627                  IF LST STEP ELSE SKIP.    OUT BUF FULL?
677     143
700    3716                  GOTO EXXCIE.               YES
701       4                  DEV1=0.
702      13                  B=WKPG.
703       3
704    2426                  CALL PG.
705    1613                  B=BEGWD.                   GET BEGIN WD
```

```
706       3
707    2466                    CALL WD.
710       3
711    2526                    CALL RD.
712     101                    B=B.                          SET COND F/FS
713    2707                    IF LST SKIP ELSE STEP.        BEG WD ON?
714      23
715    1556                    GOTO BACK.                    NO
                        STOTCK.
716       4                    DEV1=0.
717      13                    B=WKPG.
720       3
721    2426                    CALL PG.
722    6355                    BEX3 A3=A3.                   GET CLK TM
723     105                    A1=B.                         A1=CURCLK TIME
724    1533                    B=LSTWT.                      GET LAST WT
725       3
726    2466                    CALL WD.                      RECEPT TM
727       3
730    2526                    CALL RD.
731    2705                    A1=A1-B-1.                 A1=DFF
732     353                    B=VDFFWT.                     GET MAX
733    2205                    A1=A1+1.
734    2705                    A1=A1-B-1.      A1>MAXDFF?
735    1707                    IF AOV SKIP ELSE STEP.
736      23
737    7316                    GOTO PAKOUT.               ACK WAIT ROUT
740      20                    DEV0=1.                    SOFT INT
741      34                    DEV3=1.                           HRD INT NCU
742       3
743    1306                    CALL WT7MS.                WAIT FOR SYNCH
744       3
745    1306                     CALL WT7MS.
746     335                    OUT3 AMPCR=AMPCR.
747     335                    OUT3 AMPCR=AMPCR.
750      63
751    3636                    GOTO OUTQ.                    AS IF WT RECEIVED
                        *       LOOK AT OUTSTANDING
                        *       PACKET ON OUTPUT PAGE
                        *       WAITING FOR ACK
752       3
753    2426                    CALL PG.
                         PAKOUT.
                        *              MSG SENT TIMEOUTS
754       4                    DEV1=0.
755      13                    B=WKPG.
756       3
757    2426                    CALL PG.
760    1433                    B=OQNOW.
761       3
762    2466                    CALL WD.
763       3
764    2526                    CALL RD.
765     401                    B=0 EQV B.
766    3627                    IF ABT STEP ELSE SKIP.  PACK PRES?
767      23
770    1556                    GOTO BACK.
771    1473                    B=OQFR.
772       3
773    2466                    CALL WD.
```

```
 774       3
 775    2526                CALL RD.
 776     401                B=0 EQV B.
 777    3627                IF ABT STEP ELSE SKIP.  ACK WAITING?
1000      23
1001    1556                GOTO BACK.              NO
1002    6355                BEX3 A3=A3.             GET CLK TIME
1003     105                A1=B.                   A1=CURCLK TM
1004    6273                B=203.                  GET TM SENT
1005       3
1006    2466                CALL WD.
1007       3
1010    2526                CALL RD.
1011    2705                A1=A1-B-1.              A1=DFF
1012    1233                 B=VMAXCK.              GET MAX
1013    2205                A1=A1+1.
1014    2205                A1=A1+1.
1015    2705                A1=A1-B-1.
1016    1707                IF AOV SKIP ELSE STEP.  A1>MAXDFF?
1017      23
1020    1556                GOTO BACK.              NO
1021     103
1022    6316                GOTO NNACK.             YES, NAK REC
                    *
                    *        *** #2 NODE CONTROLLER MODULE ***
                    *
                     CONT.
1023     607                STEP.
1024     607                STEP.
1025     335                OUT3 AMPCR=AMPCR.                RESET EXT
1026     335                OUT3 AMPCR=AMPCR.
1027    3004                DEV1=96.
1030      13                B=ZERO.
1031       3
1032    2426                 CALL PG.
1033       3
1034    2466                CALL WD.
1035       3
1036    2526                CALL RD.                GET D1
1037     101                B=B.                    SET COND F/FS
1040    3707                IF ABT SKIP ELSE STEP.   D1=255?
1041      43
1042    1736                GOTO RS.                NO
1043       3
1044    2526                CALL RD.                YES, WT
1045     111                A2=B.                   A2=D2
1046    3004                DEV1=96.                ACCESS NCU
1047      33                B=MAIL.                 MAILBOX PG
1050       3
1051    2426                CALL PG.
1052      13                B=ZERO.                 WD 0
1053       3
1054    2466                CALL WD.
1055       3
1056    2526                CALL RD.                GET RD ADDR
1057     105                A1=B.                   A1=RD ADDR
1060    4401                B=A2 EQV B.             D2=RD ADDR?
1061    3627                IF ABT STEP ELSE SKIP.
1062      63
1063    3636                GOTO OUTQ.               YES, VALID WT
```

```
1064     113                    B=ICIE.                    WD ICIE
1065       3
1066    2466                    CALL WD.
1067    4013                    B=128.                     SET MSB
1070       3
1071    2606                    CALL WR.                   WRITE ICIE
1072      20                    DEV0=1.                    INT NCU - (READ)
1073      23
1074    1556                    GOTO BACK.                 .RETURN TO BACK
                    RS.
1075       4                    DEV1=0.
1076      13                    B=WKPG.
1077       3
1100    2426                    CALL PG.
1101    1373                    B=IQFR.
1102       3
1103    2466                    CALL WD.
1104       3
1105    2526                     CALL RD.
1106     115                    A3=B.                    A3=IQFR
1107       3
1110    2426                    CALL PG.                          PG IQFR
1111      13                    B=ZERO.
1112       3
1113    2466                    CALL WD.
1114    3004                    DEV1=96.                          ACCESS NCU
1115       3
1116    2426                    CALL PG.
1117       3
1120    2466                    CALL WD.
1121    2404                    DEV1=80.                          BLAST NCU-CIE
1122       3
1123    2646                    CALL BLAST.
1124      24                     DEV1=1.                          TERM XFER
1125       4                    DEV1=0.                           CLEAR
1126    6301                    B=A3.
1127     125                    OUT1=B.
1130      53                    B=2.                       WD 2
1131       3
1132    2466                    CALL WD.
1133       3
1134    2526                    CALL RD.                   GET D3
1135     161                    BS=B.                      ROTATE 1 RT
1136     101                    B=B.                       SET COND F/FS
1137    2707                    IF LST SKIP ELSE STEP.     R/S BIT ON?
1140      43
1141    3116                    GOTO INTRD.                NO
1142      63
1143      76                    GOTO INT0.                YES, BRDCST
                    *
                    *        *** #3 NCU READ INT MODULE ***
                    *
                     INTRD.
1144     607                    STEP.
1145     607                    STEP.
1146    3004                    DEV1=96.                   ACCESS NCU
1147      33                    B=MAIL.                    MAILBOX PG
1150       3
1151    2426                    CALL PG.
1152     113                    B=ICIE.                    WD ICIE
```

```
1153      3
1154   2466                    CALL WD.
1155   4013                    B=128.                  SET MSB
1156      3
1157   2606                    CALL WR.                WRITE INT-READ
1160      4                    DEV1=0.                 CLEAR
1161     13                    B=WKPG.                 WORKPAGE
1162      3
1163   2426                    CALL PG.
1164   1373                    B=IQFR.                 WD IQFR
1165      3
1166   2466                    CALL WD.
1167      3
1170   2526                    CALL RD.                GET IQFR
1171    105                    A1=B.                   A1=IQFR
1172      3
1173   2426                    CALL PG.                PG IQFR
1174     53                    B=2.                    WD 2
1175      3
1176   2466                    CALL WD.                GET D3
1177      3
1200   2526                    CALL RD.                B=D3
1201    101                    B=B.                    SET COND F/FS
1202   2707                    IF LST SKIP ELSE STEP.  ACK BIT ON?
1203     43
1204   4216                    GOTO CKFNK.             NO
                       *        YES, AN ACK RECEIVED
1205     20                    DEV0=1.                 INT NCU
1206    103
1207   4676                    GOTO OUTAK.             YES
                     CKFNK.
1210    101                    B=B.
1211    707                    IF MST SKIP ELSE STEP.  NAK BIT ON?
                       *        NO
1212     43
1213   4376                    GOTO CNWMD.
                       *        YES, A NAK RECEIVED
1214     20                    DEV0=1.                 INT NCU
1215    103
1216   4676                    GOTO OUTAK.             YES
                     CNWMD.
1217     13                    B=ZERO.
1220      3
1221   2466                    CALL WD.
1222      3
1223   2526                    CALL RD.
1224    115                    A3=B.
1225   2533                    B=IC1.
1226   6401                    B=A3 EQV B.
1227   3707                    IF ABT SKIP ELSE STEP.
1230     43
1231   7776                    GOTO NACM.
1232      3
1233   2526                    CALL RD.
1234    115                    A3=B.
1235   5253                    B=IC2.
1236   6401                    B=A3 EQV B.
1237   3707                    IF ABT SKIP ELSE STEP.
1240     43
1241   7776                    GOTO NACM.
```

```
1242      3
1243   1626                 CALL LPC.                          CK LPC
1244   2305                 A1=A1.
1245   2345                 BEX1 A1=A1.
1246   2401                 B=A1 EQV B.
1247   3707                  IF ABT SKIP ELSE STEP.
1250     43
1251   7776                 GOTO NACM.
1252     53                 B=2.
1253      3
1254   2466                 CALL WD.
1255      3
1256   2526                 CALL RD.
1257    161                 BS=B.                          SHIFT 2 RT
1260    161                 BS=B.
1261    101                 B=B.                           SET COND F/FS
1262   2707                 IF LST SKIP ELSE STEP.         RD ADDR ON?
1263     43
1264   6236                 GOTO TOKEN.                    NO
                     *      MODIFY READ ADDRESS -FAD-
1265    153                 B=6.                           WD 6
1266      3
1267   2466                 CALL WD.
1270      3
1271   2526                 CALL RD.                       GET D7
1272    111                 A2=B.                           A2=D7
1273   3004                 DEV1=96.                       ACCESS NCU
1274     33                 B=MAIL.                        MAILBOX PG
1275      3
1276   2426                 CALL PG.
1277     13                 B=ZERO.
1300      3
1301   2466                 CALL WD.                       RD ADDR WD
1302   4301                 B=A2.                          B=NEW FAD=D7
1303      3
1304   2606                 CALL WR.                       WRITE NEW FAD
1305     20                 DEV0=1.                        INT NCU
1306      4                 DEV1=0.                        CLEAR
                     *        DONT WRITE TO EXEDEVICE
1307     23
1310   1556                 GOTO BACK.                     EXIT
                     *      MODIFY WT ADDRESS
                      TOKEN.
1311    161                 BS=B.                          ROTATE 1 RT
1312    101                 B=B.                           SET COND F/FS
1313   2707                 IF LST SKIP ELSE STEP.         WT MOD ON?
1314     43
1315   7056                 GOTO PID.                      NO
1316    153                 B=6.                         GET D7
1317      3
1320   2466                 CALL WD.
1321      3
1322   2526                  CALL RD.
1323    111                 A2=B.                        A2=D7
1324   3004                 DEV1=96.                       ACCESS NCU
1325     33                 B=MAIL.                        MAILBOX PG
1326      3
1327   2426                 CALL PG.
1330     53                 B=2.                           WTA WD 2
1331     _3
```

```
1332    2465                    CALL WD.
1333    4301                    B=A2.                       B=D7=NEW WTA
1334       3
1335    2606                    CALL WR.                    WRT NEW WTA
1336      20                    DEV0=1.                     INT NCU
1337       4                    DEV1=0.                     CLEAR
                        *         DONT WRITE TO EXEDEVICE
1340      23
1341    1556                    GOTO BACK.                  EXIT
                        *      MOD. CONV. PG.
                         PID.
1342      20                    DEV0=1.                     INT NCU
1343     161                    BS=B.                       ROTATE 1 RT
1344     101                    B=B.                        SET COND F/FS
1345    2707                    IF LST SKIP ELSE STEP.      CONV BIT ON?
1346     123
1347    1776                    GOTO INQ.                   NO, EXIT
1350     153                     B=6.                    GET D7
1351       3
1352    2466                    CALL WD.
1353       3
1354    2526                    CALL RD.
1355     111                    A2=B.                   A2=D7
1356     173                    B=7.                      WD 7
1357       3
1360    2466                    CALL WD.
1361       3
1362    2526                    CALL RD.                    GET D8
1363     115                    A3=B.                       A3=D8
1364      33                    B=TABL.                     CONV TABL PG
1365       3
1366    2425                    CALL PG.
1367    4301                    B=A2.                       WD D7
1370       3
1371    2466                    CALL WD.                    LID TO BE CHANGED
1372    6301                    B=A3.                       B=D8.
1373       3
1374    2606                    CALL WR.                     WRITE NEW FAD
                        *         DONT WRITE TO EXODEVICE
1375      23
1376    1556                    GOTO BACK.                  EXIT
                         NACM.
1377       4                    DEV1=0.                          NOT CONT
1400      20                    DEV0=1.                          INT NCU-RD
1401     123
1402    1776                    GOTO INQ.
                        *
                        *       *** #4 NCU WRITE0 INT MODULE ***
                        *
                         INT0.
1403     607                    STEP.
1404     607                    STEP.
                        *              GET WRITE ADDR
1405       4                    DEV1=0.                          CLEAR
1406      13                    B=WKPG.                          WKPG
1407       3
1410    2426                    CALL PG.
1411    1373                    B=IQFR.
1412       3
1413    2466                    CALL WD.
```

```
1414      3
1415   2526                 CALL RD.
1416    105                 A1=B.                    A1=IQFR
1417      3
1420   2426                 CALL PG.
1421    113                 B=4.
1422      3
1423   2466                 CALL WD.
1424      3
1425   2526                 CALL RD.
1426    115                 A3=B.                    A3=D5
1427     33                 B=TABL.
1430      3
1431   2426                 CALL PG.
1432   6301                 B=A3.
1433      3
1434   2466                 CALL WD.
1435      3
1436   2526                 CALL RD.
1437    115                 A3=B.                    A3=WRT ADDR
1440   3004                  DEV1=96.                       ACCESS NCU
1441     33                 B=MAIL.                        PG 1 MAILBOX
1442      3
1443   2426                 CALL PG.
1444     33                 B=WRA.
1445      3
1446   2466                 CALL WD.
1447   6301                 B=A3.
1450      3
1451   2606                 CALL WR.
1452    113                 B=ICIE.                    CIE INT WD
1453      3
1454   2466                 CALL WD.                   WD #4
1455     33                 B=ONE.
1456      3
1457   2606                 CALL WR.                   SET ICIE=1 WRT0
1460     20                 DEV0=1.                    INT NCU
1461      4                 DEV1=0.                    CLEAR
1462     13                 B=WKPG.                    PG 3
1463      3
1464   2426                 CALL PG.                   WORKPAGE
1465   1373                 B=IQFR.
1466      3
1467   2466                 CALL WD.                   IQFR
1470      3
1471   2526                 CALL RD.
1472    105                 A1=B.                      SAVE IQFR IN A1
1473      3
1474   2426                 CALL PG.                   PG IQFR
1475     13                  B=ZERO.
1476      3
1477   2466                 CALL WD.
1500      3
1501   2526                 CALL RD.
1502    115                 A3=B.
1503   2533                 B=IC1.
1504   6401                 B=A3 EQV B.
1505   3707                  IF ABT SKIP ELSE STEP.
1506    123
1507   1776                 GOTO INQ.
```

```
1510      3
1511   2526                 CALL RD.
1512    115                 A3=B.
1513   5253                 B=IC2.
1514   6401                 B=A3 EQV B.
1515   3707                 IF ABT SKIP ELSE STEP.
1516    123
1517   1776                 GOTO INQ.
1520      3
1521   1626                 CALL LPC.                    CK LPC
1522   2305                 A1=A1.
1523   2345                 BEX1 A1=A1.
1524   2401                 B=A1 EQV B.
1525   3707                 IF ABT SKIP ELSE STEP.
1526    123
1527   1776                 GOTO INQ.
1530     53                 B=2.                         WD #2
1531      3
1532   2466                 CALL WD.                     GET D3
1533      3
1534   2526                 CALL RD.
1535    161                 BS=B.                        ROTATE 4 TIMES RT
1536    161                 BS=B.
1537    161                 BS=B.
1540    161                 BS=B.
1541    101                 B=B.                         SET COND F/FS
1542   2707                 IF LST SKIP ELSE STEP.       LST ON?
1543    123
1544   1776                 GOTO INQ.                    NO, EXIT
                     *        CHANGE CONVERSION TABLE
1545    153                 B=6.                         GET D7
1546      3
1547   2466                 CALL WD.
1550      3
1551   2526                 CALL RD.
1552    111                 A2=B.                        A2=LID TO CHANGE
1553      3
1554   2526                 CALL RD.                     GET D8
1555    115                 A3=B.                        A3=NEW FAD
1556     33                 B=TABL.
1557      3
1560   2426                 CALL PG.                     CONVERSION TABLE
1561   4301                 B=A2.                        WD=LID
1562      3
1563   2466                 CALL WD.
1564   6301                 B=A3.                        WRITE NEW FAD
1565      3
1566   2606                 CALL WR.
                     *          DONT WRITE TO EXODEVICE
1567     23
1570   1556                 GOTO BACK.                   EXIT TO BACK
                     *
                     *         *** #5 OUTPUT Q HANDLER MODULE ***
                     *
                      OUTQ.                             OUTPUT Q MODULE
1571    607                 STEP.
1572    607                 STEP.
1573      4                 DEV1=0.                      CLEAR
1574   6355                 BEX3 A3=A3.                  GET CLK TM
1575    105                 A1=B.                        A1=CLKTM
```

```
1576      13                    B=WKPG.                    PUT A1 INTO
1577       3
1600    2426                    CALL PG.                   LSTWT
1601    1533                    B=LSTWT.                   ON WKPG
1602       3
1603    2466                    CALL WD.
1604    2301                    B=A1.
1605       3
1606    2606                    CALL WR.
1607      53                    B=BLDR.
1610       3
1611    2426                    CALL PG.
1612     133                    B=AKS.
1613       3
1614    2466                    CALL WD.
1615       3
1616    2526                      CALL RD.
1617     105                    A1=B.
1620     401                    B=0 EQV B.
1621    3707                    IF ABT SKIP ELSE STEP.  AKS=0?
1622      63
1623    5016                    GOTO MOVE.              NO
1624    3004                    DEV1=96.                       YES
1625      33                    B=MAIL.
1626       3
1627    2426                    CALL PG.
1630     133                    B=AKS.
1631       3
1632    2466                    CALL WD.
1633      13                    B=ZERO.
1634       3
1635    2606                      CALL WR.
1636     103
1637      56                    GOTO PKT.
                        MOVE.
1640    2205                    A1=A1+1.
1641     133                    B=AKS.
1642       3
1643    2466                    CALL WD.
1644    2301                    B=A1.
1645       3
1646    2606                    CALL WR.
1647     113                    B=4.
1650       3
1651    2466                    CALL WD.                           GET AKFR
1652       3
1653    2526                    CALL RD.
1654     105                    A1=B.                   A1=AKFR
1655       3
1656    2466                    CALL WD.
1657    7773                    B=255.
1660    2605                    A1=A1-B.
1661      13                    B=ZERO.
                        LRZE.
1662       3
1663    2606                    CALL WR.                           WRT ZEROS
1664    2205                    A1=A1+1.
1665    3707                    IF ABT SKIP ELSE STEP.
1666      63
1667    5456                    GOTO LRZE.
```

```
1670    7753            B=254.              WD 254=EOP
1671       3
1672    2466            CALL WD.
1673    7773            B=EOP.
1674       3
1675    2606            CALL WR.
1676    1521            OUT0=0.
1677     607            STEP.
1700    3004            DEV1=96.
1701      33            B=MAIL.             MOVE MAIL PARS
1702       3
1703    2426            CALL PG.
1704      13            B=ZERO.
1705       3
1706    2466             CALL WD.
1707       3
1710    2526            CALL RD.
1711     105            A1=B.
1712       3
1713    2526             CALL RD.
1714     111            A2=B.
1715       3
1716    2526             CALL RD.
1717     115            A3=B.
1720       4            DEV1=0.
1721      53            B=BLDR.
1722       3
1723    2426            CALL PG.
1724      13            B=ZERO.
1725       3
1726    2466             CALL WD.
1727    2301             B=A1.
1730       3
1731    2606            CALL WR.
1732    4301            B=A2.
1733       3
1734    2606            CALL WR.
1735    6301            B=A3.
1736       3
1737    2606             CALL WR.
1740      13            B=VINCU.
1741       3
1742    2606            CALL WR.
1743      13            B=ZERO.
1744       3
1745    2466            CALL WD.                    BLDR-MAIL XFER
1746    3004            DEV1=96.
1747      33            B=ONE.
1750       3
1751    2426            CALL PG.
1752      13             B=ZERO.
1753       3
1754    2466            CALL WD.
1755    3204            DEV1=104.
1756       3
1757    2646            CALL BLAST.
1760       4            DEV1=0.
1761    1521            OUT0=0.
1762     607            STEP.
1763      53            B=BLDR.
```

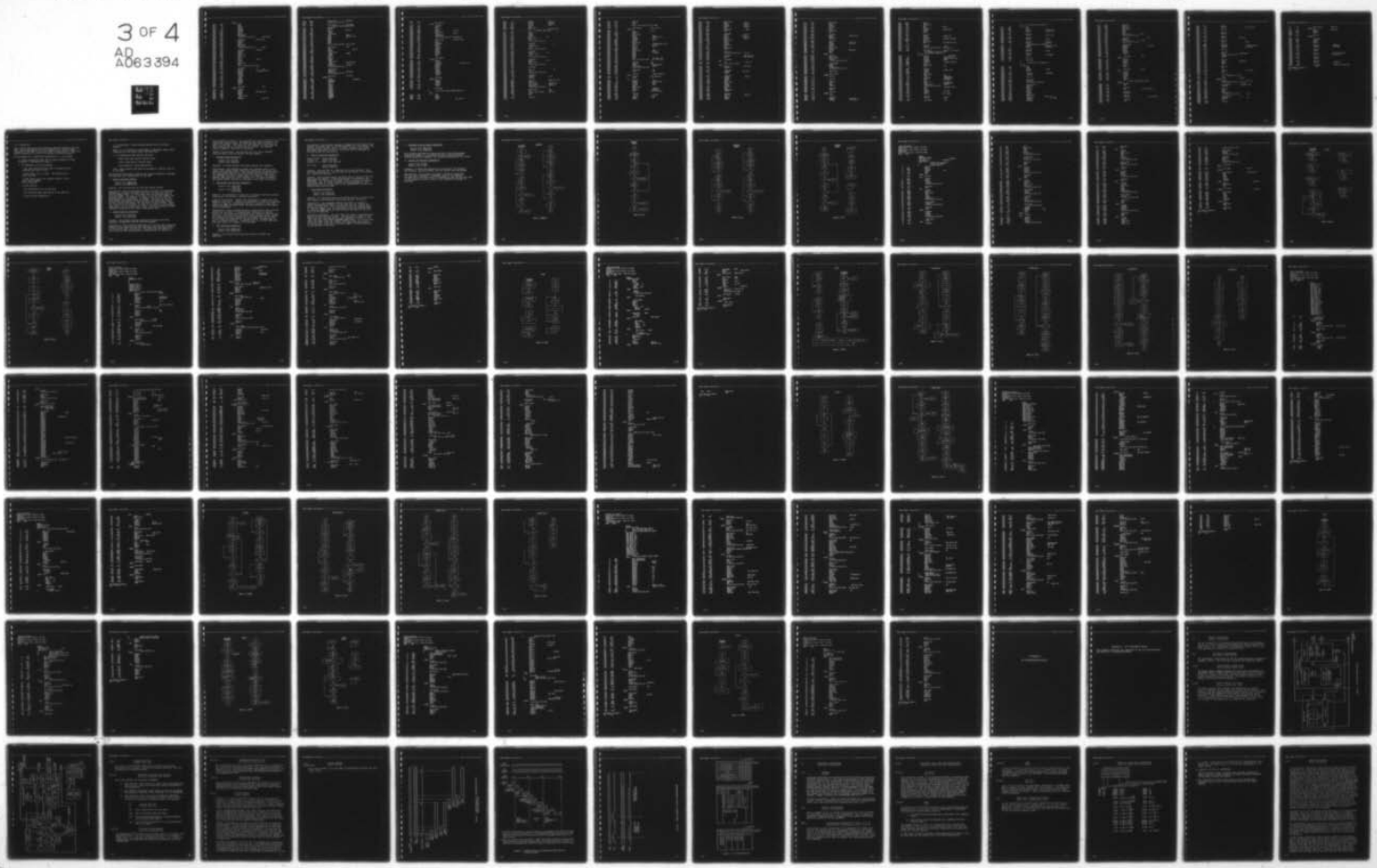
```
1764      3
1765   2426                 CALL PG.
1766     73                 B=3.
1767      3
1770   2466                 CALL WD.
1771    153                 B=VAKCUR.
1772      3
1773   2606                 CALL WR.
1774    153                  B=VAKFR.                    INIT BLDR PG
1775      3
1776   2606                 CALL WR.
1777     13                 B=VAKS.
2000      3
2001   2606                 CALL WR.
                  PKT.                                  GET OQNOW
2002      4                 DEV1=0.                     CLEAR
2003     13                 B=WKPG.
2004    125                 OUT1=B.
2005   1473                 B=OQFR.
2006    121                 OUT0=B.
2007   2305                 A1=A1.
2010   2345                 BEX1 A1=A1.
2011    401                 B=0 EQV B.
2012   3707                  IF ABT SKIP ELSE STEP.     PACK SENT?
2013    103
2014    536                 GOTO WORD2.
2015   1433                 B=OQNOW.
2016    121                 OUT0=B.
2017   2305                 A1=A1.
2020   2345                  BEX1 A1=A1.
2021    401                 B=0 EQV B.                  OQNOW=0?
2022   3707                 IF ABT SKIP ELSE STEP.
2023    103
2024   1356                 GOTO TOPQ.                  NO
                  WORD2.                                 YES,Q EMPTY
2025   3004                 DEV1=96.                    ACCESS NCU
2026     53                 B=2.                        PG 2-OUTPUT PG
2027    125                 OUT1=B.
2030   7733                 B=253.                      WD 253
2031    121                 OUT0=B.
2032     13                 B=ZERO.                      =0 TO INDICATE
2033    131                 OUT2=B.                     EMPTY PAGE
2034    607                 STEP.
2035    131                 OUT2=B.                     WD 254=0
2036    607                 STEP.
2037     33                 B=MAIL.
2040    125                 OUT1=B.
2041     53                  B=WTA.
2042    121                 OUT0=B.
2043   2305                 A1=A1.
2044   2345                 BEX1 A1=A1.
2045    105                 A1=B.
2046     33                 B=WRA.
2047    121                 OUT0=B.
2050   2301                 B=A1.
2051    131                 OUT2=B.
2052    607                 STEP.
2053      4                 DEV1=0.                     RETURN CIE MEM
2054    143
2055   3076                 GOTO INT1-2.                EXIT
```

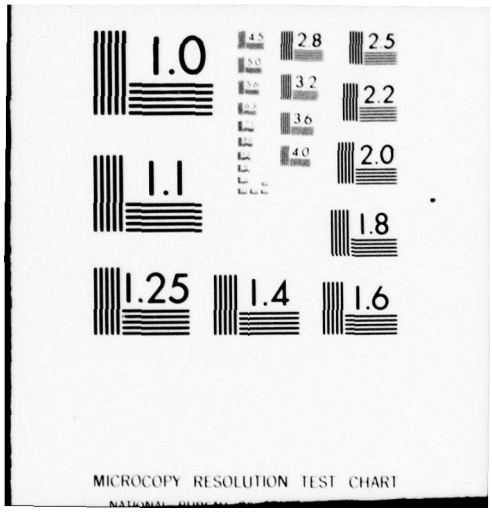
```
                    TOPQ.
2056      13                B=WKPG.                    VALID TOP OF Q
2057     125                OUT1=B.                   WKPG
2060     273                B=VOQTOP.                   GET OQTOP
2061     111                A2=B.                     . A2=OQTOP
2062    4301                B=A2.                      PG OQTOP
2063     125                OUT1=B.
                    *              SET LPC
2064       3
2065    1626                CALL LPC.
2066    2331                OUT2=A1.
2067     607                STEP.
2070     113                B=4.            GET D5
2071     121                OUT0=B.
2072    2305                A1=A1.
2073    2345                 BEX1 A1=A1.
2074     105                A1=B.                      A1=D5
2075      33                B=TABL.                    PG TABL
2076     125                OUT1=B.
2077    2301                B=A1.
2100     121                OUT0=B.                   WD D5
2101    2305                A1=A1.
2102    2345                BEX1 A1=A1.
2103     115                A3=B.                      A3=FAD
2104    4301                B=A2.                      GET D3
2105     125                OUT1=B.                   PG OQTOP
2106      53                B=2.                       WD 2
2107     121                OUT0=B.
2110    2305                A1=A1.
2111    2345                BEX1 A1=A1.
2112     161                BS=B.                      SHIFT RT
2113     161                PS=B.                      5 TMS
2114     161                BS=B.
2115     161                BS=B.
2116     161                BS=B.
2117     101                B=B.                       SET COND F/FS
2120    2707                IF LST SKIP ELSE STEP.     ALT ROUTE?
2121     103
2122    2736                GOTO NORM.                 NO
2123      33                B=VALT1.                  YES
2124    6415                A3=A3 EQV B.               ALT1=FAD?
2125    3627                IF ABT STEP ELSE SKIP.
2126     103
2127    2676                GOTO DFFF.                 YES
2130     115                A3=B.                      NO, SET FAD=ALT1
2131     103
2132    2736                GOTO NORM.
                    DFFF.
2133      53                B=VALT0.                    GET ALT0
2134     115                A3=B.
                    NORM.
2135    3004                DEV1=96.                   ACCESS NCU
2136      33                B=MAIL.                    MAIL PG
2137     125                OUT1=B.
2140      33                B=ONE.                     WD 1
2141     121                OUT0=B.
2142    6301                B=A3.                      SET WRITE ADDR
2143     131                OUT2=B.
2144     607                STEP.
2145       4                DEV1=0.                    RTN TO CIE MEM
```

```
2146    4301                    B=A2.                       PG OQTOP
2147     125                    OUT1=B.
2150    7733                    B=253.                      WD 253
2151     121                    OUT0=B.
2152    2305                    A1=A1.
2153    2345                    BEX1 A1=A1.
2154     101                    B=B.                        SET COND F/FS
2155    3627                    IF ABT STEP ELSE SKIP.      253=EOP?
2156     103
2157    3476                    GOTO MVBL.                  YES
2160    7773                    B=EOP.                      NO
2161     131                    OUT2=B.                    SET 254=EOP
2162     607                    STEP.
                    *             DO BLAST TRANSFER
                     MVBL.
2163    4301                    B=A2.                       PG OQTOP
2164     125                    OUT1=B.                    WD 0
2165      13                    B=ZERO.
2166     121                    OUT0=B.
2167    3004                    DEV1=96.                    ACCESS NCU
2170      53                    B=2.                        PG 2 - NCU
2171     125                    OUT1=B.                    WD 0
2172      13                    B=ZERO.
2173     121                    OUT0=B.
2174    3204                    DEV1=104.                   BLAST CIE-NCU
2175       3
2176    2646                    CALL BLAST.                 BLAST TRANSFER
2177       4                    DEV1=0.                     CLEAR
2200    1521                    OUT0=0.
2201     607                    STEP.
2202    6355                    BEX3 A3=A3.                 GET CLK TM
2203     105                    A1=B.                       A1=CLK TM
2204      13                    B=WKPG.                     WKPG
2205     125                    OUT1=B.                    SET OQ TM SENT
2206    6273                    B=203.                      INDICATOR
2207     121                    OUT0=B.
2210    2301                    B=A1.
2211     131                    OUT2=B.
2212     607                     STEP.
2213    3173                    B=103.
2214     121                    OUT0=B.
2215    4004                    DEV1=128.                   DISABLE,MAR INCR
2216    2305                    A1=A1.
2217    2345                    BEX1 A1=A1.
2220       1                    B=B + 1.                    INCR OQ #TMS
2221     131                    OUT2=B.                    SENT INDICATOR
2222     607                    STEP.
                    *                 SET PACKET WAIT FOR ACK
2223    1473                    B=OQFR.
2224     121                    OUT0=B.
2225      33                    B=ONE.
2226     131                    OUT2=B.
2227     607                    STEP.
2230       4                    DEV1=0.                      CLEAR
                    *             CONTINUE FOR BOTH TYPES OF NODE
2231     143
2232    3076                    GOTO INT1-2.               EXIT
                    *
                    *           *** #6 OUTSTANDING ACK HAND MODULE  ***
                    *            NO ACKS ON BROADCASTS
```

AD-A063 394 BURROUGHS CORP PAOLI PA FEDERAL AND SPECIAL SYSTEMS GROUP F/G 17/2
EXPLORATORY SYSTEMS CONTROL MODEL (ESM). SOFTWARE MAINTENANCE M--ETC(U)
APR 77 DCA100-75-C-0054
UNCLASSIFIED 66143-3-BK-2 SBIE-AD-E100 138 NL

3 OF 4
AD
A063394




1.0
1.1
1.25
1.4
1.6
1.8
2.0
2.2
2.5
2.8
3.2
3.6
4.0
MICROCOPY RESOLUTION TEST CHART

```
                        *
                    OUTAK.
2233      607               STEP.
2234      607               STEP.
2235        4               DEV1=0.
2236       13               B=WKPG.
2237      125               OUT1=B.
2240     1433               B=OQNOW.
2241      121               OUT0=B.
2242     2305               A1=A1.
2243     2345               BEX1 A1=A1.
2244      401               B=0 EQV B.
2245     3627                IF ABT STEP ELSE SKIP.          PACK PRES?
2246       23
2247     1556               GOTO BACK.                NO, JUNK REC
2250     1473               B=OQFR.
2251      121               OUT0=B.
2252     2305               A1=A1.
2253     2345               BEX1 A1=A1.
2254      401               B=0 EQV B.
2255     3627                IF ABT STEP ELSE SKIP.          WAIT?
2256       23
2257     1556               GOTO BACK.                JUNK REC
2260     1373               B=IQFR.
2261      121               OUT0=B.
2262     2305               A1=A1.
2263     2345               BEX1 A1=A1.
2264      115               A3=B.
2265      125               OUT1=B.
2266       53               B=2.                      GET D3
2267      121               OUT0=B.
2270     2305               A1=A1.
2271     2345               BEX1 A1=A1.
2272      101               B=B.
2273     2707               IF LST SKIP ELSE STEP.    ACK?
2274      103
2275     6316               GOTO NNACK.               NO
2276       13               B=WKPG.                         YES
2277      125               OUT1=B.                   SET OQNOW, OQFR=0
2300     1433               B=OQNOW.
2301      121               OUT0=B.
2302       13               B=ZERO.
2303      131                OUT2=B.
2304      607                STEP.
2305     1473               B=OQFR.
2306      121               OUT0=B.
2307       13               B=ZERO.
2310      131               OUT2=B.
2311      607               STEP.
2312       23
2313     1556               GOTO BACK.                      EXIT
                    NNACK.
2314       13               B=WKPG.
2315      125               OUT1=B.
2316     3173               B=103.                    GET #TMS SENT
2317      121               OUT0=B.
2320     2305               A1=A1.
2321     2345                 BEX1 A1=A1.
2322      105               A1=B.
2323       53               B=VMAXTR.                       GET MAX
```

```
2324    2405                A1=A1 EQV B.            #TMS=MAX?
2325    3707                IF ABT SKIP ELSE STEP.
2326     123
2327    1616                GOTO RRLNKS.            NO RESEND
                *                 YES ALT ROUTE ROUTINE HERE
2330     273                B=VOQTOP.
2331     125                OUT1=B.
2332      53                B=2.                    GET D3
2333     121                OUT0=B.
2334    2305                 A1=A1.
2335    2345                 BEX1 A1=A1.
2336     105                A1=B.                   A1=D3
2337     161                BS=B.                   ROTATE 5 TMS
2340     161                BS=B.
2341     161                BS=B.
2342     161                BS=B.
2343     161                BS=B.
2344     101                B=B.
2345    2627                IF LST STEP ELSE SKIP.  ALTRT USED?
2346     123
2347     416                GOTO PSLLD.             YES
2350     113                B=4.
2351     121                OUT0=B.                         GET D5
2352    2305                A1=A1.
2353    2345                 BEX1 A1=A1.
2354     111                 A2=B.                  A2=D5
2355      33                B=TABL.
2356     125                OUT1=B.
2357    4301                B=A2.
2360     121                OUT0=B.
2361    2305                A1=A1.
2362    2345                 BEX1 A1=A1.
2363     111                 A2=B.                  A2=WRT ADDR
2364      33                B=VALT1.
2365    4401                B=A2 EQV B.             A2=VALT1?
2366    3627                IF ABT STEP ELSE SKIP.
2367     103
2370    7756                GOTO ALTROK.
2371      53                B=VALT0.
2372    4401                B=A2 EQV B.             A2=VALT0
2373    3707                IF ABT SKIP ELSE STEP.
2374     123
2375     416                GOTO PSLLD.             NO ALTRT
              ALTROK.
2376    1013                B=32.
2377    2105                A1=A1+B.                        A1=NEW D3
2400     273                B=VOQTOP.
2401     125                OUT1=B.
2402      53                B=2.
2403     121                OUT0=B.
2404    2301                 B=A1.
2405     131                OUT2=B.
2406     607                STEP.
2407      13                B=WKPG.
2410     125                OUT1=B.
2411    3173                B=103.
2412     121                OUT0=B.
2413      13                B=ZERO.
2414     131                OUT2=B.
2415     607                STEP.
```

```
2416      123
2417     1616                    GOTO RRLNKS.
                          PSLLD.
2420      273                    B=VOQTOP.
2421      125                    OUT1=B.
2422      113                    B=4.
2423      121                    OUT0=B.
2424     2305                    A1=A1.                    GET D5
2425     2345                    BEX1 A1=A1.
2426      105                    A1=B.                     A1=D5
2427       33                     B=VADDLID.
2430     2401                    B=A1 EQV B.
2431     3627                    IF ABT STEP ELSE SKIP.  D5=VADDLID?
2432      123
2433     1256                    GOTO KLLPAC.              YES, KILL PACK
2434      113                    B=4.
2435      121                    OUT0=B.
2436       33                    B=VADDLID.
2437      131                    OUT2=B.
2440      607                    STEP.
2441       13                     B=WKPG.
2442      125                    OUT1=B.
2443     3173                    B=103.
2444      121                    OUT0=B.
2445       13                    B=ZERO.
2446      131                    OUT2=B.
2447      607                    STEP.
2450      123
2451     1616                    GOTO RRLNKS.
                          KLLPAC.
2452       13                    B=WKPG.
2453      125                    OUT1=B.
2454     1433                     B=OQNOW.                          DESTROY PACK
2455      121                    OUT0=B.
2456       13                    B=ZERO.
2457      131                    OUT2=B.
2460      607                    STEP.
2461     1473                    B=OQFR.
2462      121                     OUT0=B.
2463       13                    B=ZERO.
2464      131                     OUT2=B.
2465      607                     STEP.
2466       23
2467     1556                    GOTO BACK.
                          RRLNKS.
2470     1473                    B=OQFR.
2471      121                     OUT0=B.
2472       13                    B=ZERO.
2473      131                    OUT2=B.
2474      607                     STEP.
2475       23
2476     1556                    GOTO BACK.
                        *
                        *       *** #7 CIE TO INPUT QUEUE HANDLER ***
                        *
                         INQ.
2477      607                    STEP.
2500      607                    STEP.
2501        4                    DEV1=0.
2502     1505                    A1=0.                       INIT LPC WD
```

```
2503      13                B=WKPG.                    PG 3
2504     125                OUT1=B.                    WORKPAGE
2505    1373                B=IQFR.                    WD IQFR
2506     121                OUT0=B.                    IQFR
2507    2305                A1=A1.
2510    2345                BEX1 A1=A1.
2511     115                A3=B.                      A3=IQFR VALUE
                      *          IF HDR=EOP, THROW AWAY
2512    6301                B=A3.
2513     125                OUT1=B.
2514      33                B=ONE.
2515     121                OUT0=B.
2516    2305                A1=A1.                  D2
2517    2345                BEX1 A1=A1.
2520     101                B=B.
2521    3627                IF ABT STEP ELSE SKIP.
2522      23
2523    1556                GOTO BACK.
2524    2305                 A1=A1.                        D3
2525    2345                  BEX1 A1=A1.
2526     101                B=B.
2527    3627                IF ABT STEP ELSE SKIP.
2530      23
2531    1556                GOTO BACK.
2532    2305                A1=A1.                  D4
2533    2345                  BEX1 A1=A1.
2534     101                B=B.
2535    3627                 IF ABT STEP ELSE SKIP.
2536      23
2537    1556                GOTO BACK.
2540    2305                A1=A1.                  D5
2541    2345                BEX1 A1=A1.
2542     101                B=B.
2543    3627                IF ABT STEP ELSE SKIP.
2544      23
2545    1556                GOTO BACK.
2546       3
2547    2526                CALL RD.                       D6
2550     101                B=B.
2551    3627                IF ABT STEP ELSE SKIP.
2552      23
2553    1556                GOTO BACK.
2554      13                B=ZERO.                    WD 0
2555     121                OUT0=B.
2556       3
2557    1626                CALL LPC.                  FORM LPC IN A1
2560    2305                A1=A1.
2561    2345                BEX1 A1=A1.                GET LPC WD
2562    4607                IF LC1 STEP.               RESETS LC1
2563    2401                B=A1 EQV B.                LPC OK?
2564    3707                IF ABT SKIP ELSE STEP.
2565     123
2566    4116                GOTO CSTPP.                NO
2567     201                B=1.                       YES
2570    2007                IF LST SET LC1 STEP.       SET LC1
2571     607                STEP.
2572      53                B=2.
2573       3
2574    2466                CALL WD.
2575       3
```

```
2576    2526                CALL RD.
2577     161                BS=B.
2600     101                B=B.
2601    2627                IF LST STEP ELSE SKIP.  R/S MODE?
2602     143
2603    2016                GOTO IQLINK.            YES, LINK IQ
                    CSTPP.
2604     133                B=5.                    WD. 5
2605     121                OUT0=B.
2606    2305                A1=A1.
2607    2345                BEX1 A1=A1.
2610     105                A1=B.                     A1=D6
2611      33                B=TABL.                   CONV TABL PG
2612     125                OUT1=B.                   PG 4
2613    2321                OUT0=A1.                  WD D6
2614    2305                A1=A1.
2615    2345                BEX1 A1=A1.
2616     105                A1=B.                     A1=D0=FAD=WRT ADDR
2617    6325                OUT1=A3.                  PG IQFR
2620      53                B=2.                      WD 2
2621     121                OUT0=B.
2622    2305                A1=A1.
2623    2345                BEX1 A1=A1.               B=D3
2624     161                BS=B.                     SHIFT RT
2625     161                BS=B.                     5 TIMES
2626     161                BS=B.
2627     161                BS=B.
2630     161                BS=B.
2631     101                B=B.                      SET COND F/FS
2632    2707                IF LST SKIP ELSE STEP.    ALT ROUT USED?
2633     123
2634    5216                GOTO D0.                NO
2635      33                B=VALT1.                YES
2636     111                A2=B.                     A2=UST ROUTE
2637    2401                B=A1 EQV B.               A1=A2?
2640    3627                IF ABT STEP ELSE SKIP.
2641     123
2642    5156                GOTO OTHR.                YES
2643    4305                A1=A2.                    NO
2644     123
2645    5216                GOTO D0.                  D0=1ST ROUTE=A1
                    OTHR.
2646      53                B=VALT0.                USE OTHER RTE
2647     105                A1=B.
                    D0.
2650      53                B=BLDR.                   PG 5
2651     125                OUT1=B.                   ACK/NAK BLDR
2652     113                B=AKFR.                   WD 4
2653     121                OUT0=B.                   AKFR
2654    2305                A1=A1.
2655    2345                BEX1 A1=A1.
2656     111                A2=B.                     A2=AKFR
2657    4321                OUT0=A2.                  WD#=AKFR
2660    2301                B=A1.                   WRT D0 TO BLDR
2661       3
2662    2606                CALL WR.
2663    6325                OUT1=A3.                  PG IQFR
2664     133                B=5.                    WD #5
2665     121                OUT0=B.                   D6
2666    2305                A1=A1.
```

```
2667    2345                BEX1 A1=A1.
2670     105                A1=B.                    A1=D6
2671      53                B=BLDR.                   PUT D6
2672     125                OUT1=B.                  AS D5
2673    4211                A2=A2 + 1.               ON BLDR
2674     113                B=4.
2675    4121                OUT0=A2+B.                 PAGE
2676    2301                B=A1.
2677       3
2700    2606                 CALL WR.
2701    6325                OUT1=A3.                  GET D5
2702     113                B=4.                   & PUT AS
2703     121                OUT0=B.                   D6 ON
2704    2305                A1=A1.                    BLDR PG
2705    2345                BEX1 A1=A1.
2706     105                A1=B.
2707      53                B=BLDR.
2710     125                OUT1=B.
2711    4211                A2=A2 + 1.
2712     113                B=4.
2713    4121                OUT0=A2+B.
2714    2301                B=A1.
2715       3
2716    2606                CALL WR.
2717    4627                IF LC1 STEP ELSE SKIP.   LPC OK?
2720     123
2721    6536                GOTO ACK.                YES, BLD ACK
2722    4013                B=128.                   NO, BLD NAK
2723     123
2724    6576                GOTO AKNK.
                        ACK.
2725     201                B=1.                       SET LL1
2726    2007                IF LST SET LC1 STEP.
                        AKNK.
2727    4211                A2=A2 + 1.               WRT D3=B
2730    4321                OUT0=A2.
2731       3
2732    2606                 CALL WR.
2733    4211                A2=A2+1.               SET D4=0
2734      13                B=ZERO.
2735       3
2736    2606                 CALL WR.
2737    6325                OUT1=A3.                   MOVE D1
2740      13                B=ZERO.
2741     121                OUT0=B.
2742    2305                A1=A1.
2743    2345                BEX1 A1=A1.
2744     105                A1=B.
2745      53                B=BLDR.
2746     125                OUT1=B.
2747    4211                A2=A2 + 1.
2750     113                B=4.
2751    4621                OUT0=A2-B.
2752    2301                 B=A1.
2753       3
2754    2606                CALL WR.
2755    6325                OUT1=A3.                 MOVE D2
2756     201                B=1.
2757     121                OUT0=B.
2760    2305                A1=A1.
```

```
2761    2345                BEX1 A1=A1.
2762     105                A1=B.
2763      53                B=BLDR.
2764     125                OUT1=B.
2765    4211                A2=A2 + 1.
2766     113                B=4.
2767    4621                OUT0=A2-B.
2770    2301                B=A1.
2771       3
2772    2606                CALL WR.
2773    7773                B=EOP.                  FORM D7=EOP
2774    4211                A2=A2 + 1.
2775    4321                OUT0=A2.
2776       3
2777    2606                CALL WR.
3000    1505                A1=0.                   INIT LPC
3001     113                B=AKFR.                 GET AKFR
3002     121                OUT0=B.
3003    2305                A1=A1.
3004    2345                BEX1 A1=A1.
3005       1                B=B+1.
3006     121                OUT0=B.                 WD=AKFR+1
3007     153                B=6.
3010     115                A3=B.
                    ALPCK.
3011    2305                A1=A1.
3012    2345                BEX1 A1=A1.
3013    2505                A1=A1 XOR B.
3014    6215                A3=A3+1.
3015    3627                 IF ABT STEP ELSE SKIP.
3016     143
3017     616                GOTO NOAEOP.
3020     111                A2=B.
3021    7773                B=EOP.
3022    4411                A2=A2 EQV B.
3023    3707                IF ABT SKIP ELSE STEP.
3024     143
3025     236                GOTO ALPCK.
3026     143
3027    1136                GOTO SUCEOP.
                    NOAEOP.
3030     113                B=AKFR.
3031       3
3032    2466                CALL WD.
3033       3
3034    2526                CALL RD.
3035     111                A2=B.
3036     173                B=7.
3037    4101                B=A2+B.
3040       3
3041    2466                CALL WD.
3042    7773                B=EOP.
3043       3
3044    2606                CALL WR.
                    SUCEOP.
3045    2301                B=A1.
3046       3
3047    2606                CALL WR.
3050     113                B=AKFR.                 GET AKFR
3051     121                OUT0=B.                 PUT INTO A1
```

```
3052    2305                A1=A1.
3053    2345                BEX1 A1=A1.
3054     105                A1=B.
3055     233                B=9.                    ADD 9
3056    2105                A1=A1 + B.
3057     113                B=AKFR.                 UPDATE AKFR
3060     121                OUT0=B.
3061    2301                B=A1.
3062       3
3063    2606                CALL WR.
3064     133                B=AKS.                  UPDATE AKS
3065     121                OUT0=B.
3066    4004                DEV1=128.               DISABLE AUTOINCR
3067    2305                A1=A1.
3070    2345                BEX1 A1=A1.
3071       1                B=B + 1.                ONE MORE ACK/NAK
3072       3
3073    2606                CALL WR.
3074       4                DEV1=0.                 CLEAR
3075    4707                IF LC1 SKIP ELSE STEP.  DID LPC CK?
3076      23
3077    1556                GOTO BACK.              NO, DONT LINK PACKETT
                    *        CRT CONNECTED CIE MUST STRIP
                    *        OFF PROTOCOL CHARACTERS
                     IQLINK.
3100       4                DEV1=0.                      CLEAR DEV
3101      13                B=WKPG.                 YES, LINK TO IQ
3102     125                OUT1=B.                 UPDATE CURR Q SIZE
3103    1333                B=IQNOW.                IQNOW
3104     121                OUT0=B.
3105    4004                DEV1=128.               DISABLE AUTOINCR
3106    2305                F1=A1.
3107    2345                BEX1 A1=A1.
3110       1                B=B + 1.                INC
3111       3
3112    2606                CALL WR.
3113    1373                B=IQFR.                 UPDATE IQFR
3114     121                OUT0=B.
3115    2305                A1=A1.
3116    2345                BEX1 A1=A1.
3117       1                B=B + 1.                INC
3120     105                A1=B.                   CHECK FOR
3121     213                B=VIQMAX.                WRAPAROUND
3122     111                A2=B.                   A2=IQMAX
3123      73                B=3.
3124    4111                A2=A2 + B.              PT INTO Q
3125    2301                B=A1.                   A1=NEW IQFR
3126    4411                A2=A2 EQV B.            A1=A2?
3127    3627                IF ABT STEP ELSE SKIP.
3130      73                B=3.                    YES, RESET IQFR
3131     607                STEP.
3132     105                A1=B.
3133    1373                B=IQFR.                 WD IQFR
3134     121                OUT0=B.
3135    2301                B=A1.                  WRT TO MEM
3136       3
3137    2606                CALL WR.
3140       4                DEV1=0.                 CLEAR
3141      23
3142    1556                GOTO BACK.              EXIT
```

```
                                *
                                *       *** #8 NCU INT1,2 MODULE ***
                                 INT1-2.
3143      607                           STEP.
3144      607                           STEP.
3145     3004                           DEV1=96.                    ACCESS NCU
3146       33                           B=MAIL.                     MAILBOX PG
3147        3
3150     2426                           CALL PG.
3151      113                           B=ICIE.                     CIE INT WD
3152        3
3153     2466                           CALL WD.
3154       13                           B=ZERO.                     SET=0
3155        3
3156     2606                           CALL WR.                    WRITE1,2
3157       20                           DEV0=1.                     INT NCU
                                *         SET BEGWD FOR WT TIMEOUTS
3160        4                           DEV1=0.                     ACCESS CIE MEM
3161       13                           B=WKPG.                     WORKPAGE
3162        3
3163     2426                           CALL PG.
3164     1613                           B=BEGWD.                    BEGWD
3165        3
3166     2466                           CALL WD.
3167       33                           B=ONE.                      SET BEGWD
3170        3
3171     2606                           CALL WR.
3172       23
3173     1556                           GOTO BACK.
                                *
                                *       *** #9 EXT TO CIE MODULE ***
                                *
                                 EXXCIE.
3174      607                           STEP.
3175      607                           STEP.
3176        4                           DEV1=0.                     CLEAR
3177       13                           B=WKPG.
3200        3
3201     2426                           CALL PG.                    WORKPAGE
3202     1433                            B=OQNOW.
3203        3
3204     2466                           CALL WD.
3205        3
3206     2526                            CALL RD.
3207      401                           B=0 EQV B.
3210     3707                           IF ABT SKIP ELSE STEP.
3211       23
3212     6356                           GOTO STOTCK.
3213      273                           B=VOQTOP.
3214      105                           A1=B.
3215       13                           B=WKPG.
3216      125                           OUT1=B.
3217     4673                           B=155.
3220      121                           OUT0=B.
3221     2305                           A1=A1.
3222     2345                           BEX1 A1=A1.
3223      111                            A2=B.                  A2=WD LOC
3224     4004                           DEV1=128.                      RD CHAR
3225     2325                           OUT1=A1.
3226     4321                           OUT0=A2.
```

```
3227    4044                DEV1=130.
3230    4064                DEV1=131.
3231    4004                DEV1=128.
3232    2345                BEX1 A1=A1.
3233     607                STEP.
3234     115                A3=B.
3235    7213                B=CR.
3236    6401                B=A3 EQV B.             =CR?
3237    3627                IF ABT STEP ELSE SKIP.
3240     143
3241    5636                GOTO CRR.                       YES
3242    5233                B=CONU.
3243    6401                B=A3 EQV B.             =CONU?
3244    3627                IF ABT STEP ELSE SKIP.
3245     143
3246    5416                GOTO CONUR.
3247    4211                A2=A2+1.                        REG CHAR
3250      13                B=WKPG.
3251     125                OUT1=B.
3252    4673                B=155.
3253     121                OUT0=B.
3254    4331                OUT2=A2.
3255     607                 STEP.
3256      23
3257    1556                 GOTO BACK.             EXIT
                    CONUR.
3260      13                B=WKPG.
3261     125                OUT1=B.
3262    4673                B=155.
3263     121                OUT0=B.
3264     153                B=6.
3265     131                OUT2=B.
3266     607                STEP.
3267      23
3270    1556                GOTO BACK.             EXIT
                    CRR.
3271      13                B=WKPG.
3272     125                OUT1=B.
3273    4673                B=155.
3274     121                OUT0=B.
3275     153                B=6.
3276     131                OUT2=B.
3277     607                STEP.
                    *               BUILD LOOP PROTOCOL CHARS
                    BLPPC.
3300       4                DEV1=0.
3301    2301                B=A1.
3302       3
3303    2426                CALL PG.
3304     113                B=4.                   SET D5=VPDDLID
3305       3
3306    2466                CALL WD.
3307     133                B=VPDDLID.
3310       3
3311    2606                CALL WR.
3312     233                B=VOLID.                        SET D6=VOLID
3313       3
3314    2606                 CALL WR.
3315      53                B=2.
3316       3
```

```
3317    2466                CALL WD.
3320      13                B=ZERO.                       SET D3,D4=0
3321       3
3322    2606                CALL WR.
3323       3
3324    2606                CALL WR.
3325      13                B=ZERO.
3326       3
3327    2466                CALL WD.
3330      33                B=ONE.                  SET D1=1
3331       3
3332    2606                CALL WR.
3333      13                B=WKPG.                       WKPG
3334       3
3335    2426                CALL PG.
3336    4004                DEV1=128.                     DISABLE AUTOINCR
3337    4613                B=MSGNO.                      GET MSGNO
3340       3
3341    2466                CALL WD.
3342       3
3343    2526                CALL RD.
3344       1                B=B+1.                  INCR MSGNO
3345    3627                IF ABT STEP ELSE SKIP.
3346      13                 B=ZERO.
3347     607                STEP.
3350       3
3351    2606                CALL WR.
3352     111                A2=B.                   A2=MSGNO
3353       4                DEV1=0.
3354    2301                B=A1.
3355       3
3356    2426                CALL PG.
3357     201                B=1.
3360       3
3361    2466                CALL WD.                      SET D2=A2
3362    4301                B=A2.
3363       3
3364    2606                CALL WR.
                    *             REPLACE ETX BY EOP
3365     133                B=5.
3366     111                 A2=B.                  WD PTR
                    REPLETX.
3367    4211                A2=A2+1.                      INCR PTR
3370    3627                IF ABT STEP ELSE SKIP. LAST WD?
3371     163
3372     256                GOTO WRETXM.           YES,ERROR COND
3373    4321                OUT0=A2.
3374       3
3375    2526                CALL RD.
3376     115                A3=B.
3377    7213                B=CR.
3400    6401                B=A3 EQV B.
3401    3707                 IF ABT SKIP ELSE STEP.       =ETX?
3402     143
3403    7576                GOTO REPLETX.          NO
3404    4321                OUT0=A2.                      YES
3405    7773                B=EOP.
3406       3
3407    2606                CALL WR.
3410     163
```

```
 3411      376                  GOTO INSRLPC.          FORM LPC
                        WRETXM.
 3412     7753                  B=254.                 MAKE EOP
 3413      121                  OUT0=B.
 3414     7773                  B=EOP.
 3415        3
 3416     2606                  CALL WR.
                        INSRLPC.
 3417        3
 3420     1626                   CALL LPC.
 3421     2331                  OUT2=A1.
 3422      607                  STEP.
 3423       13                  B=WKPG.
 3424        3
 3425     2426                  CALL PG.                 WORKPAGE
 3426     1433                  B=OQNOW.                 GET OQNOW
 3427        3
 3430     2466                  CALL WD.
 3431       33                  B=ONE.
 3432        3
 3433     2606                  CALL WR.                 WRT BACK TO MEM
 3434     3173                  B=103.                 INIT #TMS IND
 3435        3
 3436     2466                  CALL WD.
 3437       13                  B=ZERO.
 3440        3
 3441     2606                  CALL WR.
 3442        4                  DEV1=0.                  CLEAR DEV
 3443       23
LB444     1556                  GOTO BACK.                RETURM TO BKGND MODU
                                  END?.
THE NUMBER OF ERRORS= 0
TT1  --  STOP
>
```

2.3 Diagnostics

This section describes the diagnostic programs supplied with the ESM. These programs provide the capability to verify proper operation of the ESM or to verify that a fault exists. They also permit isolation of a fault to a specific hardware element.

The procedure for loading the diagnostic(s) is as follows:

1. Mount Diagnostic Tape (#4) on Tape Transport of Host Processor B (connected to Loop 2).

2. At DECscope, do the following:

   - Set User Identification code to Access File by entering SET /UIC = [1,4]

   - Move object file to disk. FLX DKO:/FB:256. = MTO: file.OBJ

   - Load object file into suspect node(s)' CIE's.
   RUN [20,20] ESMLDR
   Enter filename.

3. At ESM cabinet:

   - Set LD/EN Switch to Up position

   - Set Selected Node LOAD Switch to Up position

   - Depress M-CLR pushbutton.

4. At DECscope: Press Carriage Return key to initiate loading.

NOTE: It is possible to load nodes in different loops simultaneously but not nodes within the same loop.

5. At appropriate ESM cabinet and node:

- Reset Node LOAD Switch (Switch Down)

- Reset LD/EN Switch (Switch Down)

- Run diagnostic using ESM Monitor.

Note: When loading with Monitor plugged-in, Monitor must be in Run mode.

The following paragraphs identify the various diagnostic programs and describe their application to the ESM:

1. Memory Checking Program

Source file MEMCK.DAT
Object file MEMCKO.OBJ

Purpose: For checking NCU and CIE data memory boards.

Description: The bit patterns 10101010, 01010101 and sequential numbers are written into memory and read out again for all NCU and CIE memory pages. If all checks pass the program hangs at location NOERR. If there is an error in the NCU data memory the program hangs at the NCUERR. If there is an error in the CIE data memory the program hangs at CIEERR. The operator may then single step the program to find the word and page number where the test failed and examine the contents of the bad page. There are a total of 44 CIE pages, 16 each on the first two CIE memory cards and 12 on the third card. Thus, a failure on page 16 would indicate a problem on the second data memory card.

2. Block Transfer Diagnostic

Source file BLKS.DAT
Object file BLOUT.OBJ

Purpose: For checking memory reading and writing and block transfers between NCU and CIE ancillary boards.

Description: This program loads page 0 of the NCU with sequential numbers, reads them from the CIE and then block transfers page 0 of the NCU to page 3 of the CIE. The result of the transfer is then read and the program hangs at location NG1 on failure to

read sequential numbers. The program then loads CIE page 6 with sequential numbers, reads the data and then block transfers to page 2 of the NCU. The result of the transfer is then read and the program hangs at location NG2 on failure. The program hangs at HANG5 if there are no failures.

Special Instructions: The NCU must be in a "Don't EXECUTE" state so that it may not modify its data memory.

3. Gateway Debug Diagnostic

Source file GTB.DAT
Object file GTBO.OBJ

Purpose: To check gateway interfaces between two cabinets.

Description: The program is loaded into gateway nodes in two loops. One gateway sends sequential numbers to the other gateway which reads the result. The sending gateway loads CIE page 0 with sequential numbers, sends the page across the interface and then may read the original page, if required. The reading gateway code starts at octal location 40. It block transfers the output buffer contents to CIE page 1 and reads the results.

4. CRT-to-CRT via Gateway Diagnostic

Source files CTCC.DAT
CTCG.DAT
Object files CTCCO.OBJ
CTCGO.OBJ

Purpose: For checking in loops #2, #3 gateway interface, partial loop (node) verification, and CRT interfaces.

Loading Instructions: Object file CTCCO.OBJ is loaded into CRT nodes on loops #2,3. Object file CTCGO.OBJ is loaded into gateway node GB in loop #2, and gateway node GA in loop #3. Put other nodes into DNEX and CLEAR state via panel-mounted switches while running diagnostic.

Description: These programs accept a packet from a CRT, send the packet via the loop to a gateway node, transfer the packet across the interface, and then deliver the packet to the CRT via the loop. After hitting the master clear and loop clear, acceptable operation allows a packet to be transmitted from one CRT to the other CRT connected to the other loop. Messages may be sent in either direction. A terminal that is in local mode will beep when there is a packet to be received.

5. CRT Interface Diagnostic

Source file CRTCK.DAT
Object file CRTOBJ.OBJ

Purpose: For checking CRT interface boards and TD802 CRT operation.

Description: This program accepts a packet from the CRT and then resends the packet back to the CRT preceded by 7 line feeds. The operator types a packet (up to 3 lines), transmits the packet and proper operation results in the packet being displayed on the bottom part of the screen.

6. PDP-11 Interface Diagnostic

PDP-11 files: (listed in Section 1.7.1)
Source PDP.FOR
Object PDP.OBJ
Task [1,4] PDP.TSK

CIE files:
Source PDP.DAT
Object PDPO.OBJ

Loading: Load the PDP-11 connected CIE's with PDPO.OBJ. Run the CIE connected B7*. Run the task on the PDP-11 to be tested; i.e., RUN [1,4] PDP.TSK.

Purpose: This program checks the M1710 PDP-11 interface and the Host Interface Board. A three-line-packet is entered on the DECWRITER. The CIE hangs (at HNG1) after receiving the packet, and memory page 20 can be examined by single-stepping. The packet may then be written back to the DECWRITER by running the program from location WRTB.

7. Loop Check Diagnostic

Source file LPCK.DAT
Object file LPCKO.OBJ

Purpose: For checking reading and writing ability of Loop Interface boards, loop operation, and Clock-Retimer operation.

Description: This program contains the code for writing a packet of sequential numbers to the loop and for reading the packet from the loop. For a successful read the program hangs at location NOERR. For an unsuccessful read the program hangs at location ERROR where the word location and data of the bad read can be examined.

Operating Procedures: For each loop, one node is designated the writer and one node the reader. For the writer, toggle in two STEP (hex 187) instructions at octal addresses 16 and 17. Put other two nodes into DON'T EXECUTE,CLEAR state. To run the test clear the loop, clear the reader, and then clear the writer. The reader will then halt at location ERROR or NOERR depending on the outcome of the test.

8. Extended Gateway Debug Diagnostic

Source file GTBA.DAT
Object file GTBOA.OBJ

This program performs the same function as the GTBO gateway diagnostic except it is extended so that received packets (having sequential numbers) are checked automatically for errors.

9. Silent 700 Terminal Diagnostic

Source file TI.DAT
Object file TI.OBJ

Purpose: To check the operation of the Silent 700 Terminal, the terminal interface board- and the leased line and modems.

Description: This program provides a loop-back capability for the remote terminal. A message typed on the terminal followed by a carriage return is received by the CIE and sent back to the terminal so that a copy of the transmitted message is received.

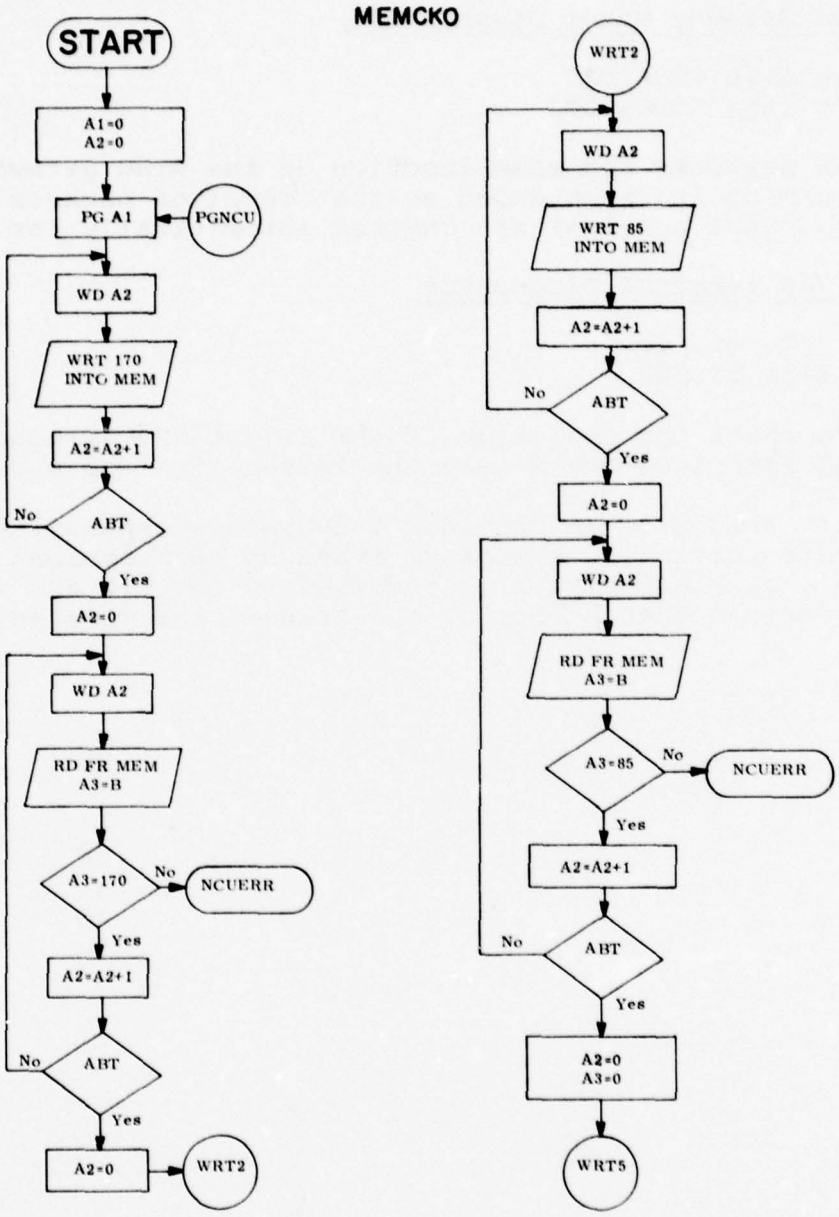


Figure 2-8. MEMCKO

MEMCKO (cont.)

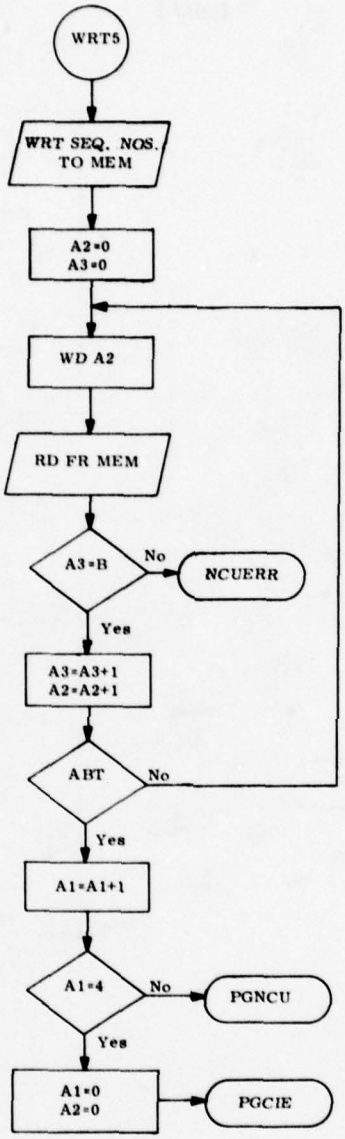


Figure 2-8. (Cont.)

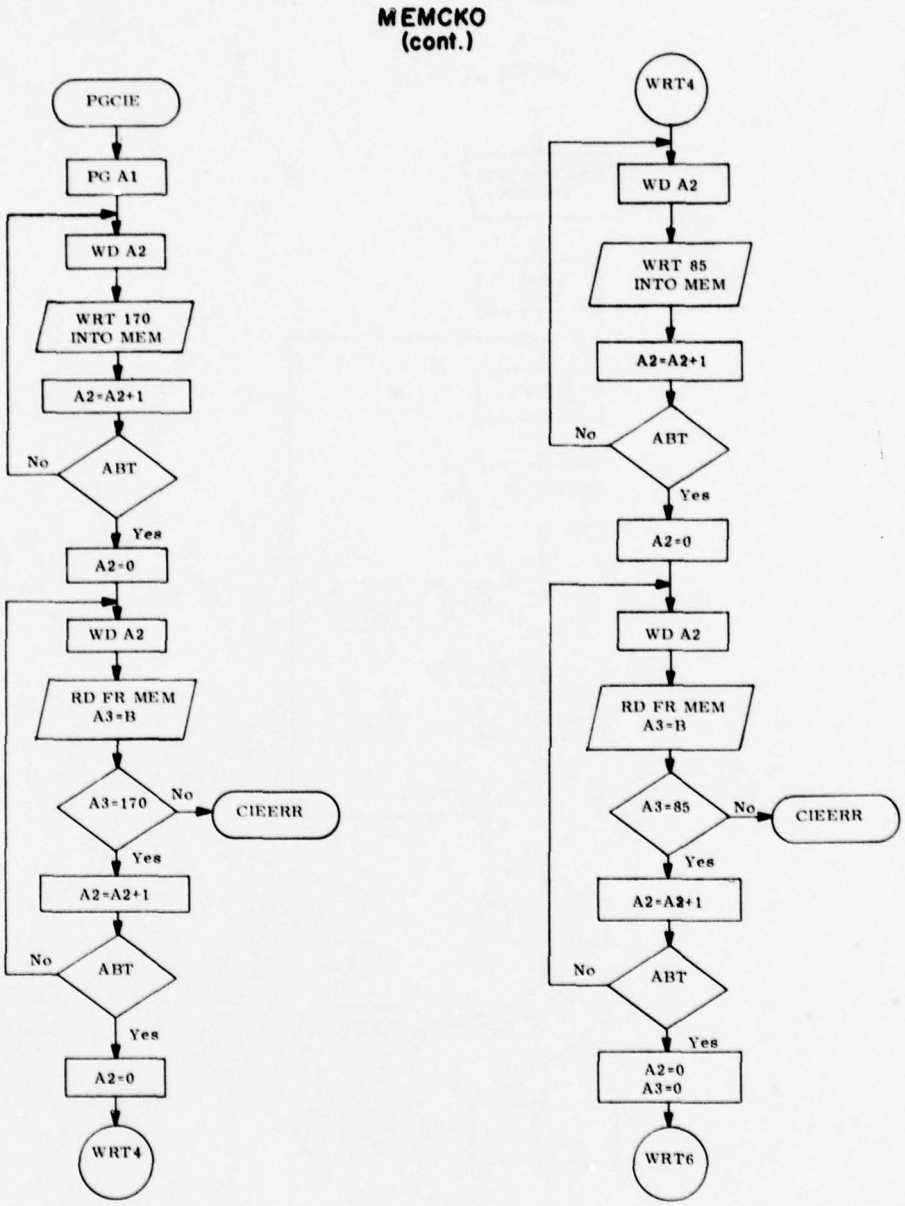


Figure 2-8. (Cont.)

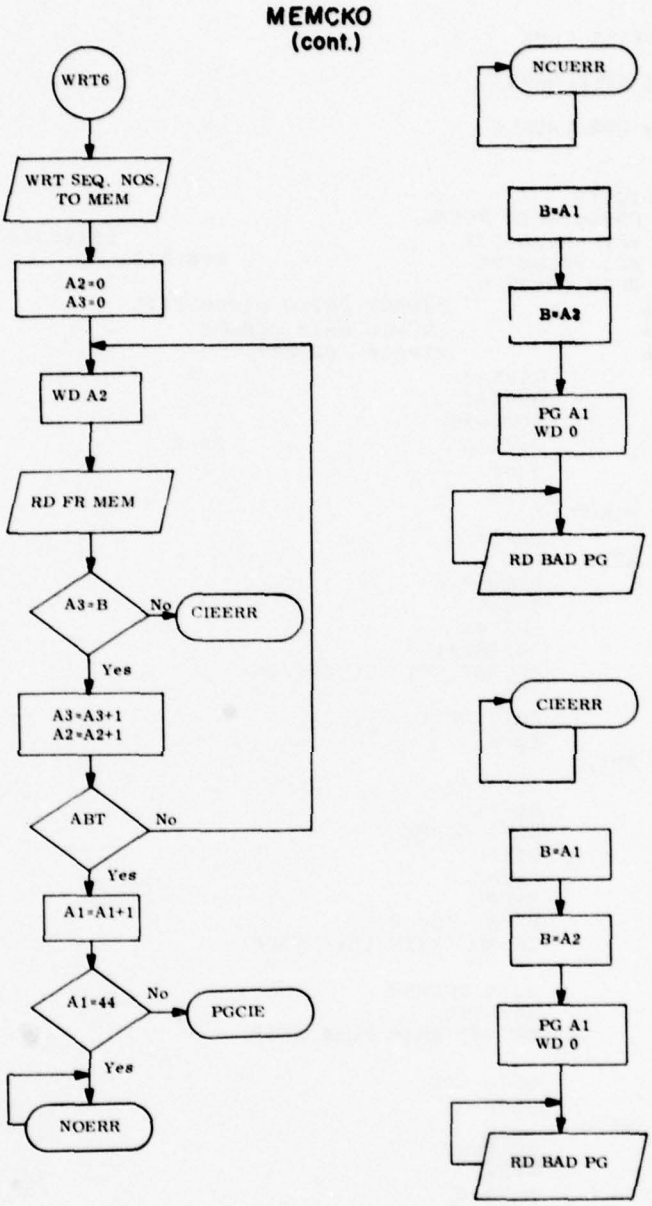


Figure 2-8. (Cont.)

```
 RUN.[20,20]MDMPL
PLEASE ENTER INPUT SOURCE FILE NAME
MEMCK.DAT
PLEASE ENTER OUTPUT OBJECT FILE NAME
MEMCK0.OBJ
WAIT FOR FIRST PASS - SCAN FOR LABELS
MPAD      CODE

                        $12BIT
                         PROGRAM-ID MEMCK.
                         WR1 VALUE 170.                          10101010
                         WR2 VALUE 85.                    01010101
                         ZERO VALUE 0.
                        *                MEMORY CKING DIAGNOSTIC
                        *                CK NCU DATA MEMORY
                        *                A1=PG#  A2=WD#
    0         4                    DEV1=0.
    1      1521                    OUT0=0.
    2      3004                    DEV1=96.
    3        13                    B=ZERO.                  PG 0
    4       105                    A1=B.
    5      1511                    A2=0.
                         PGNCU.
    6      2325                    OUT1=A1.
                         WRT1.
    7      4321                    OUT0=A2.
   10      5253                    B=WR1.
   11       131                    OUT2=B.
   12      4211                     A2=A2+1.
   13      3707                    IF ABT SKIP ELSE STEP.
   14         3
   15       176                    GOTO WRT1.
   16      1511                    A2=0.
                         RD1.
   17      4321                    OUT0=A2.
   20      2305                    A1=A1.
   21      2345                    BEX1 A1=A1.
   22       607                    STEP.
   23       115                     A3=B.
   24      5253                    B=WR1.
   25      6415                    A3=A3 EQV B.
   26      3707                    IF ABT SKIP ELSE STEP.
   27         3
   30      5136                    GOTO NCUERR.
   31      4211                    A2=A2+1.
   32      3707                    IF ABT SKIP ELSE STEP.
   33         3
   34       376                    GOTO RD1.
   35      1511                    A2=0.
                         WRT2.
   36      4321                    OUT0=A2.
   37      2533                    B=WR2.
   40       131                    OUT2=B.
   41      4211                    A2=A2+1.
   42      3707                    IF ABT SKIP ELSE STEP.
   43         3
   44       756                     GOTO WRT2.
   45      1511                    A2=0.
                         RD2.
   46      4321                    OUT0=A2.
```

```
 47    2305                    A1=A1.
 50    2345                    BEX1 A1=A1.
 51     607                    STEP.
 52     115                    A3=B.
 53    2533                    B=WR2.
 54    6415                    A3=A3 EQV B.
 55    3707                    IF ABT SKIP ELSE STEP.
 56       3
 57    5136                    GOTO NCUERR.
 60    4211                    A2=A2+1.
 61    3707                    IF ABT SKIP ELSE STEP.
 62       3
 63    1156                    GOTO RD2.
 64    1511                    A2=0.
 65    1515                    A3=0.
                       WRT5.
 66    4321                    OUT0=A2.
 67    6331                    OUT2=A3.
 70    6215                    A3=A3+1.
 71    4211                    A2=A2+1.
 72    3707                    IF ABT SKIP ELSE STEP.
 73       3
 74    1556                    GOTO WRT5.
 75    1511                    A2=0.
 76    1515                    A3=0.
                       RD5.
 77    4321                    OUT0=A2.
100    2305                     A1=A1.
101    2345                    BEX1 A1=A1.
102     607                    STEP.
103    6401                    B=A3 EQV B.
104    3707                    IF ABT SKIP ELSE STEP.
105       3
106    5136                    GOTO NCUERR.
107    6215                    A3=A3+1.
110    4211                    A2=A2+1.
111    3707                    IF ABT SKIP ELSE STEP.
112       3
113    1776                    GOTO RD5.
114    2205                    A1=A1+1.
115     113                    B=4.
116    2401                    B=A1 EQV B.
117    3707                    IF ABT SKIP ELSE STEP.
120       3
121     156                    GOTO PGNCU.
                       *              CK CIE DATA MEM
122    1521                     OUT0=0.
123       4                    DEV1=0.
124      13                    B=ZERO.                 PG 0
125     105                    A1=B.
126    1511                    A2=0.
                       PGCIE.
127    2325                    OUT1=A1.
                       WRT3.
130    4321                    OUT0=A2.
131    5253                    B=WR1.
132     131                    OUT2=B.
133    4211                    A2=A2+1.
134    3707                    IF ABT SKIP ELSE STEP.
135       3
```

```
136     2616                    GOTO WRT3.
137     1511                    A2=0.
                        RD3.
140     4321                    OUT0=A2.
141     2305                    A1=A1.
142     2345                     BEX1 A1=A1.
143      607                    STEP.
144      115                    A3=B.
145     5253                     B=WR1.
146     6415                    A3=A3 EQV B.
147     3707                    IF ABT SKIP ELSE STEP.
150        3
151     5456                    GOTO CIEERR.
152     4211                    A2=A2+1.
153     3707                    IF ABT SKIP ELSE STEP.
154        3
155     3016                    GOTO RD3.
156     1511                     A2=0.
                        WRT4.
157     4321                    OUT0=A2.
160     2533                    B=WR2.
161      131                    OUT2=B.
162     4211                    A2=A2+1.
163     3707                    IF ABT SKIP ELSE STEP.
164        3
165     3376                    GOTO WRT4.
166     1511                    A2=0.
                        RD4.
167     4321                    OUT0=A2.
170     2305                     A1=A1.
171     2345                    BEX1 A1=A1.
172      607                    STEP.
173      115                    A3=B.
174     2533                    B=WR2.
175     6415                    A3=A3 EQV B.
176     3707                    IF ABT SKIP ELSE STEP.
177        3
200     5456                    GOTO CIEERR.
201     4211                    A2=A2+1.
202     3707                     IF ABT SKIP ELSE STEP.
203        3
204     3576                     GOTO RD4.
205     1511                    A2=0.
206     1515                    A3=0.
                        WRT6.
207     4321                    OUT0=A2.
210     6331                    OUT2=A3.
211     6215                    A3=A3+1.
212     4211                    A2=A2+1.
213     3707                    IF ABT SKIP ELSE STEP.
214        3
215     4176                    GOTO WRT6.
216     1511                    A2=0.
217     1515                    A3=0.
                        RD6.
220     4321                    OUT0=A2.
221     2305                    A1=A1.
222     2345                     BEX1 A1=A1.
223      607                    STEP.
224     6401                    B=A3 EQV B.
```

```
 225     3707                    IF ABT SKIP ELSE STEP.
 226        3
 227     5456                    GOTO CIEERR.
 230     6215                    A3=A3+1.
 231     4211                    A2=A2+1.
 232     3707                    IF ABT SKIP ELSE STEP.
 233        3
 234     4416                    GOTO RD6.
 235     2205                    A1=A1+1.
 236     1313                    B=44.
 237     2401                    B=A1 EQV B.
 240     3707                    IF ABT SKIP ELSE STEP.
 241        3
 242     2576                    GOTO PGCIE.
                         NOERR.
 243        3
 244     5076                    GOTO NOERR.                     MEM OK!
                         NCUERR.
 245        3
 246     5136                    GOTO NCUERR.                    NCU MEM BAD!
 247     2301                    B=A1.
 250      607                    STEP.
 251     4301                     B=A2.
 252      607                    STEP.
 253     2325                    OUT1=A1.
 254     1521                     OUT0=0.
                         LKNCU.                                          RD BAD P
 255     2305                    A1=A1.
 256     2345                    BEX1 A1=A1.
 257      607                    STEP.
 260        3
 261     5336                    GOTO LKNCU.
                         CIEERR.                                         CIE MEM
 262        3
 263     5456                    GOTO CIEERR.
 264     2301                    B=A1.
 265      607                    STEP.
 266     4301                     B=A2.
 267      607                    STEP.
 270     2325                     OUT1=A1.
 271     1521                    OUT0=0.
                         LKCIE.
 272     2305                    A1=A1.
 273     2345                    BEX1 A1=A1.
 274      607                    STEP.
 275        3
 276     5656                    GOTO LKCIE.
                                 END?.

THE NUMBER OF ERRORS= 0
TT1  --  STOP
>
```

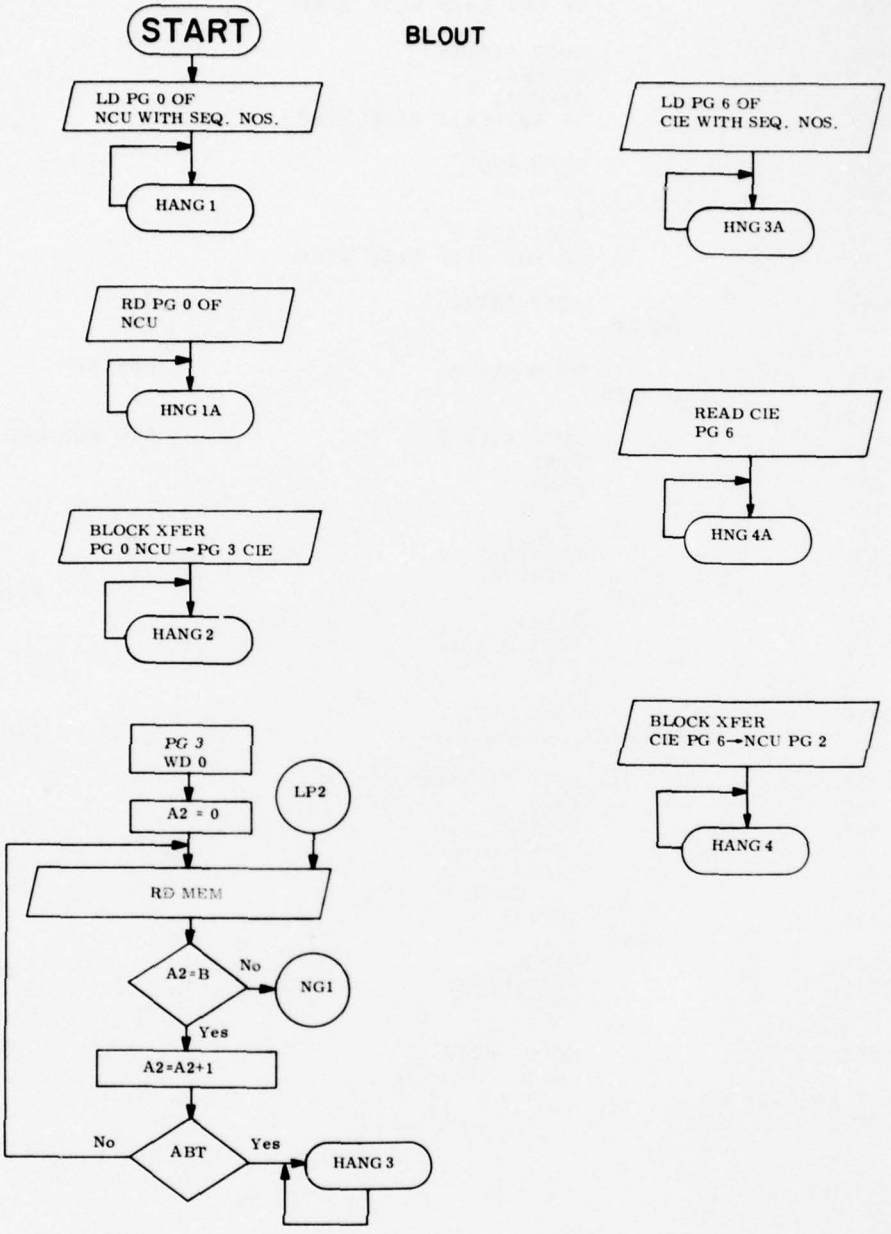


Figure 2-9. BLOUT

BLOUT (cont.)

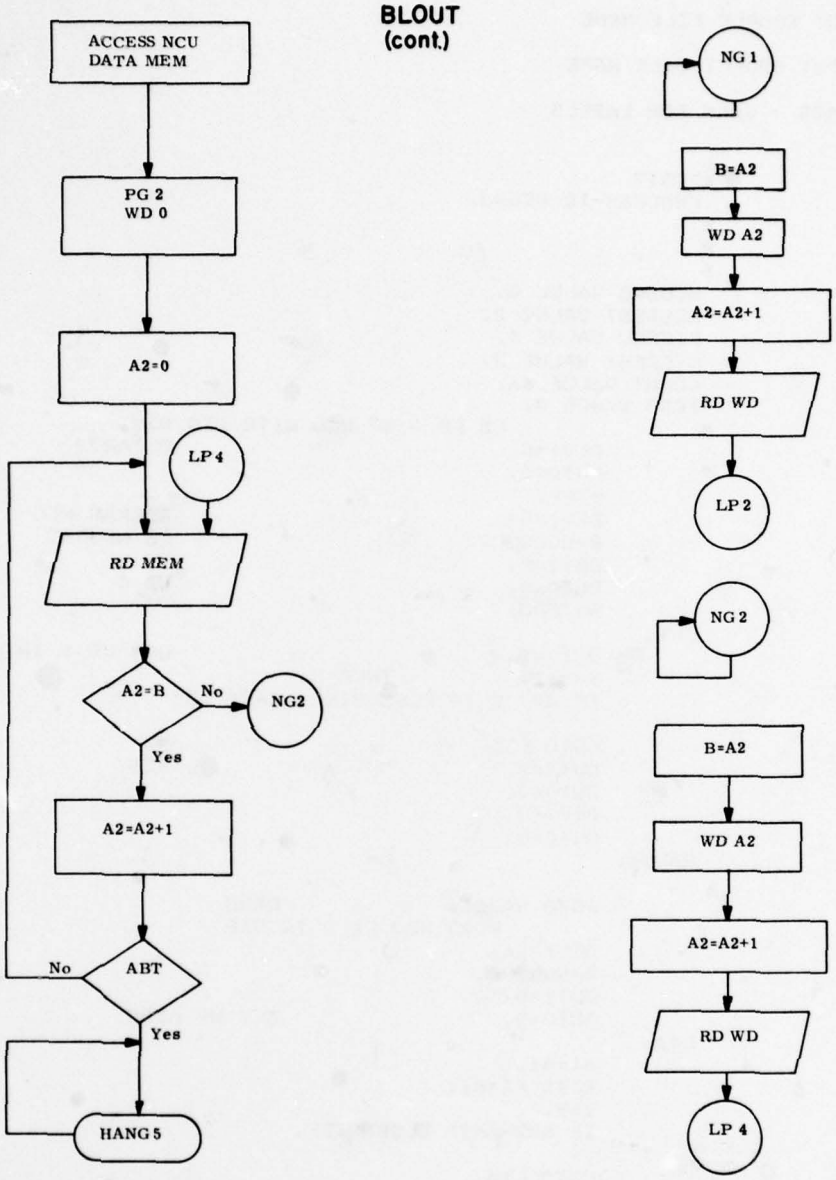


Figure 2-9. (Cont.)

```
>RUN [20,20]MDMPL
PLEASE ENTER INPUT SOURCE FILE NAME
BLKS.DAT
PLEASE ENTER OUTPUT OBJECT FILE NAME
BLOUT.OBJ
WAIT FOR FIRST PASS - SCAN FOR LABELS
MPAD     CODE

                        $12BIT
                         PROGRAM-ID BSOBJ.
                        *
                        *
                        *
                         NCUSRC VALUE 0.
                         NCUDEST VALUE 2.
                         CIESRC VALUE 6.
                         CIEDEST VALUE 3.
                         COUNT VALUE 66.
                         ZERO VALUE 0.
                        *               LD PG 0 OF NCU WITH SEQ NOS.
    0        4                  DEV1=0.                          CLEAR
    1     1521                  OUT0=0.
    2      607                  STEP.
    3     3004                  DEV1=96.                         ACCESS NCU
    4       13                  B=NCUSRC.                        PG NCUSRC
    5      125                  OUT1=B.
    6     1521                  OUT0=0.                          WD 0
    7       13                  B=ZERO.
                         LP1.
   10      131                  OUT2=B.                          WRT WD # INTO MEM
   11        1                  B=B+1.          INCR B
   12     3707                  IF ABT SKIP ELSE STEP. LAST WD?
   13        3
   14      216                  GOTO LP1.                        NO
   15      131                  OUT2=B.                          YES
   16     1521                  OUT0=0.
   17        4                  DEV1=0.
   20     1521                  OUT0=0.
                         HANG1.
   21        3
   22      436                  GOTO HANG1.              HANG
                        *               READ NCU PG 0 IN CIE
   23     3004                  DEV1=96.
   24       13                  B=NCUSRC.
   25      125                  OUT1=B.
   26     1521                  OUT0=0.                  SET WD ADDR
                         L1A.
   27     2305                  A1=A1.
   30     2345                  BEX1 A1=A1.
   31      101                  B=B.
   32     3707                  IF ABT SKIP ELSE STEP.
   33        3
   34      576                  GOTO L1A.
   35     1521                  OUT0=0.
   36        4                  DEV1=0.
   37     1521                  OUT0=0.
                         HNG1A.
   40        3
   41     1016                  GOTO HNG1A.
                        *               BLAST NCU-CIE
```

```
42        4                    DEV1=0.                          ACCESS CIE
43       73                    B=CIEDEST.                 PG CIEDEST
44      125                    OUT1=B.
45     1521                    OUT0=0.                          WD 0
46      607                    STEP.
47     3004                    DEV1=96.                         ACCESS NCU
50       13                    B=NCUSRC.                        PG NCUSRC
51      125                    OUT1=B.
52     1521                    OUT0=0.
53     2404                    DEV1=80.
54     2053                    B=COUNT.
                     AGAIN.
55        1                    B=B+1.                     INCR CTR
56     3707                    IF ABT SKIP ELSE STEP. TST CTR
57        3
60     1336                    GOTO AGAIN.
61       24                    DEV1=1.                          TERMINATE BLAST
62     1521                    OUT0=0.
63        4                    DEV1=0.
64     1521                    OUT0=0.
                     HANG2.
65        3
66     1536                    GOTO HANG2.
                   *               READ FROM CIE
67        4                    DEV1=0.                          CLEAR
70       73                    B=CIEDEST.
71      125                    OUT1=B.
72       13                    B=ZERO.
73      121                    OUT0=B.
74     1511                    A2=0.
                     LP2.
75     2305                    A1=A1.
76     2345                    BEX1 A1=A1.
77     4415                    A3=A2 EQV B.
100    3707                    IF ABT SKIP ELSE STEP.
101       3
102    4216                    GOTO NG1.
103    4211                    A2=A2+1.
104     101                    B=B.
105    3707                    IF ABT SKIP ELSE STEP.
106       3
107    1736                    GOTO LP2.
110    1521                    OUT0=0.
                     HANG3.
111       3
112    2236                    GOTO HANG3.
                   *               LOAD CIE MEM AND BLAST TO NCU
113       4                    DEV1=0.
114     153                    B=CIESRC.                        PG CIESRC
115     125                    OUT1=B.
116    1521                    OUT0=0.                          WD 0
117      13                    B=ZERO.
                     LP3.
120     131                    OUT2=B.
121       1                    B=B+1.
```

```
122     3707                    IF ABT SKIP ELSE STEP.
123        3
124     2416                    GOTO LP3.
125      131                    OUT2=B.
126     1521                    OUT0=0.
                        HNG3A.
127        3
130     2576                    GOTO HNG3A.             HANG
                      *               READ CIE MEM
                        L3A.
131     2305                    A1=A1.
132     2345                    REX1 A1=A1.
133      101                    B=B.
134     3707                    IF ABT SKIP ELSE STEP.
135        3
136     2636                    GOTO L3A.
137     1521                    OUT0=0.
                        HNG4A.
140        3
141     3016                    GOTO HNG4A.
                      *               BLAST CIE-NCU
142     1521                    OUT0=0.                         WD 0
143      607                    STEP.
144     3004                    DEV1=96.                        ACCESS NCU
145       53                    B=NCUDEST.              PG NCUDEST
146      125                    OUT1=B.
147     1521                    OUT0=0.                         WD 0
150     3204                    DEV1=104.                       CIE-NCU BLAST
151     2053                    B=COUNT.
                        AG.
152        1                    B=B+1.
153     3707                    IF ABT SKIP ELSE STEP.
154        3
155     3256                    GOTO AG.
156        4                    DEV1=0.
157     1521                    OUT0=0.
                        HANG4.
160        3
161     3416                    GOTO HANG4.
                      *               READ FROM NCU
162     3004                    DEV1=96.                        ACCESS NCU
163       53                    B=NCUDEST.
164      125                    OUT1=B.                         PG NCUDEST
165       13                    B=ZERO.
166      121                    OUT0=B.
167     1511                    A2=0.
                        LP4.
170     2305                    A1=A1.
171     2345                    REX1 A1=A1.
172     4415                    A3=A2 EQV B.
173     3707                    IF ABT SKIP ELSE STEP.
174        3
175     4476                    GOTO NG2.
176     4211                    A2=A2+1.
177      101                    B=B.                    SET COND F/FS
200     3707                    IF ABT SKIP ELSE STEP.
201        3
202     3616                    GOTO LP4.
203     1521                    OUT0=0.
204        4                    DEV1=0.
```

```
  205     1521                    OUT0=0.
                          HANG5.
  206        3
  207     4156                    GOTO HANG5.
                          NG1.
  210        3
  211     4216                    GOTO NG1.
  212     4301                    B=A2.
  213      607                    STEP.
  214     4321                    OUT0=A2.
  215     4211                   A2=A2+1.
  216     2305                    A1=A1.
  217     2345                    BEX1 A1=A1.
  220      607                    STEP.
  221        3
  222     1736                    GOTO LP2.
                          NG2.
  223        3
  224     4476                    GOTO NG2.
  225     4301                    B=A2.
  226      607                    STEP.
  227     4321                    OUT0=A2.
  230     4211                    A2=A2+1.
  231     2305                    A1=A1.
  232     2345                    BEX1 A1=A1.
  233      607                    STEP.
  234        3
  235     3616                    GOTO LP4.
                                  END?.
THE NUMBER OF ERRORS= 0
TTO  --  STOP
>
```

GTBO

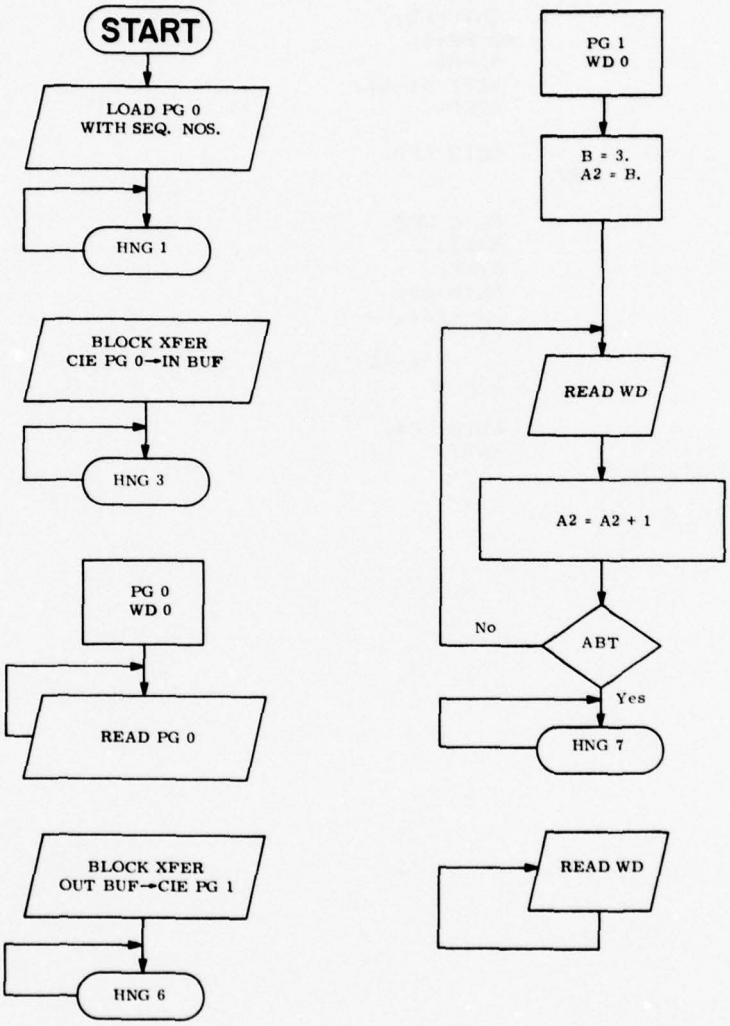


Figure 2-10. GTBO

```
 RUN [20,20]MDMPL
PLEASE ENTER INPUT SOURCE FILE NAME
GTB.DAT
PLEASE ENTER OUTPUT OBJECT FILE NAME
GTBO.OBJ
WAIT FOR FIRST PASS - SCAN FOR LABELS
MPAD     CODE

                        $12BIT
                         PROGRAM-ID GTDB.
    0        4                  DEV1=0.
    1     1501                  B=0.
    2      125                   OUT1=B.
    3     1501                      B=0.     WD
    4      121                   OUT0=B.
    5     1501                     B=0.     DATA
    6      131                   OUT2=B.
                        SEVN.
    7        1                    B=B+1.
   10      131                   OUT2=B.
   11     3707                    IF ABT SKIP ELSE STEP.
   12        3
   13      176                      GO TO SEVN.
                        HNG1.
   14        3
   15      316                     GO TO HNG1.
   16        4                 DEV1=0.
   17       30                 DEV2=1.
   20      607                 STEP.
   21     1525                 OUT1=0.
   22     1501                   B=0.      WD
   23      121                    OUT0=B.
   24      104                    DEV1=4.      BLSTGY
                        HNG2.
   25        3
   26      536                 GOTO HNG2.      HANG
   27       24                   DEV1=1.
   30      607                     STEP.
   31       30                 DEV2=1.                  SND STATUS
                        HNG3.
   32        3
   33      656                    GOTO HNG3.
   34     1501                    B=0.       PG
   35      125                    OUT1=B.
   36     1501                     B=0.      WD
   37      121                    OUT0=B.
   40        4                     DEV1=0.
                        REED.
   41     2345                     BEX1 A1=A1.      READ
   42        3
   43     1036                     GO TO REED.
                       *              GATEWAY TO CIE
   44        4                 DEV1=0.
   45     4351                 BEX2 A2=A2.
   46      201                 B=1.
   47      125                   OUT1=B.
   50     1501                 B=0.
   51      121                 OUT0=B.                  SET WD
   52       44                  DEV1=2.                 BLAST TO CIE
                        HNG5.
```

```
  53        3
  54     1276                    GOTO HNG5.      HANG
  55       24                    DEV1=1.                 TERM BLAST
  56      607                    STEP.
  57     4351                    BEX2 A2=A2.     SEND STATUS
                          HNG6.
  60        3
  61     1416                    GOTO HNG6.      HANG
  62      201                    B=1.            PG 1
  63      125                    OUT1=B.
  64     1501                    B=0.            WD 0
  65      121                    OUT0=B.
  66       73                    B=3.            SET CTR
  67      111                    A2=B.
  70        4                    DEV1=0.                 CHNG DEV
                          RDRES.
  71     2345                     BEX1 A1=A1.    READ FR CIE
  72     4211                     A2=A2+1.
  73     3707                     IF ABT SKIP ELSE STEP.
  74        3
  75     1636                    GOTO RDRES.     REPEAT
                          HNG7.
  76        3
  77     1756                    GOTO HNG7.
 100      607                    STEP.
                          RDRES1.
 101     2345                      BEX1 A1=A1.
 102        3
 103     2036                    GOTO RDRES1.
                                 END?.

THE NUMBER OF ERRORS= 0
TTO  --  STOP
>
```

CTCCO

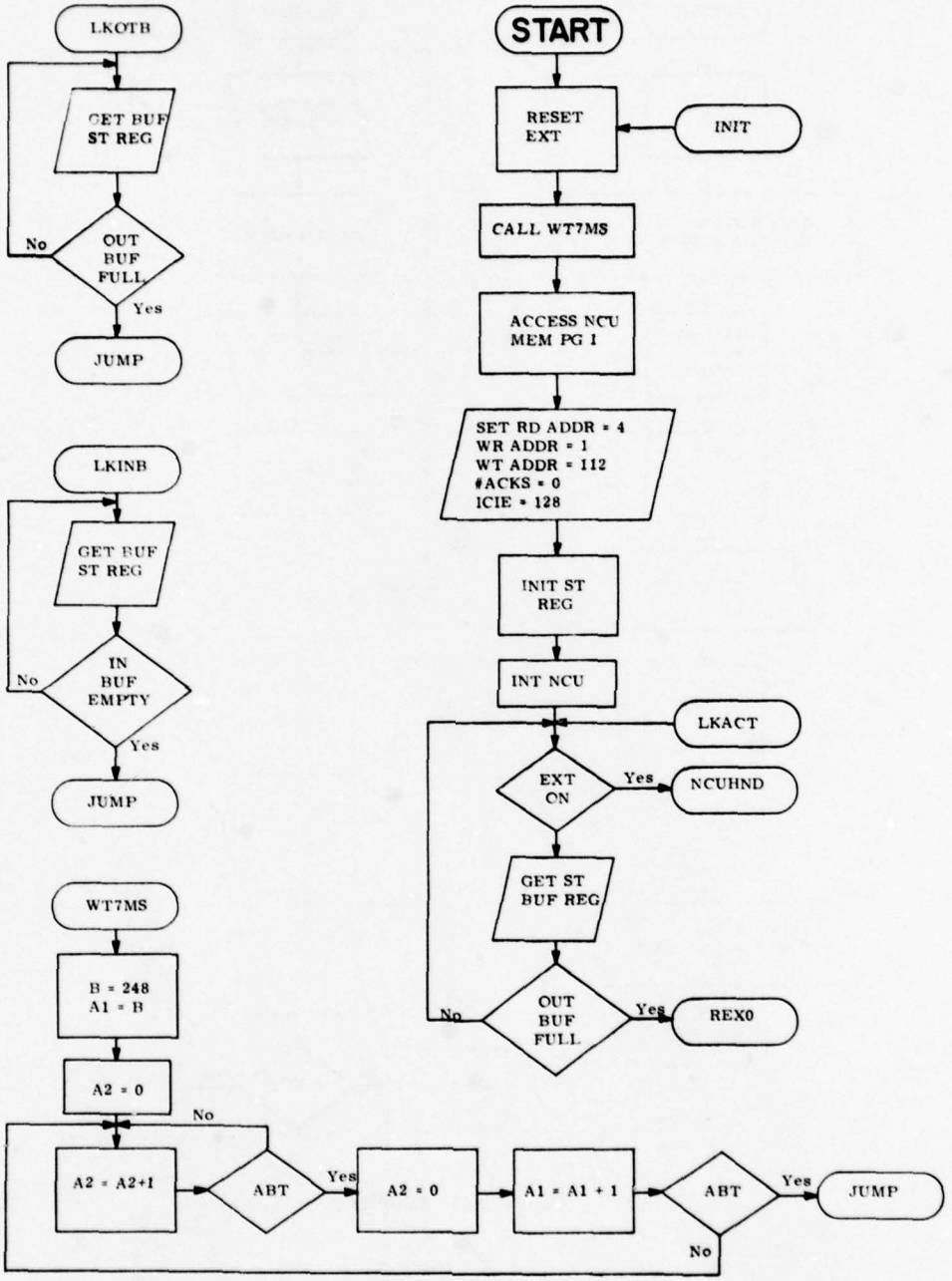


Figure 2-11. CTCCO

CTCCO (cont.)

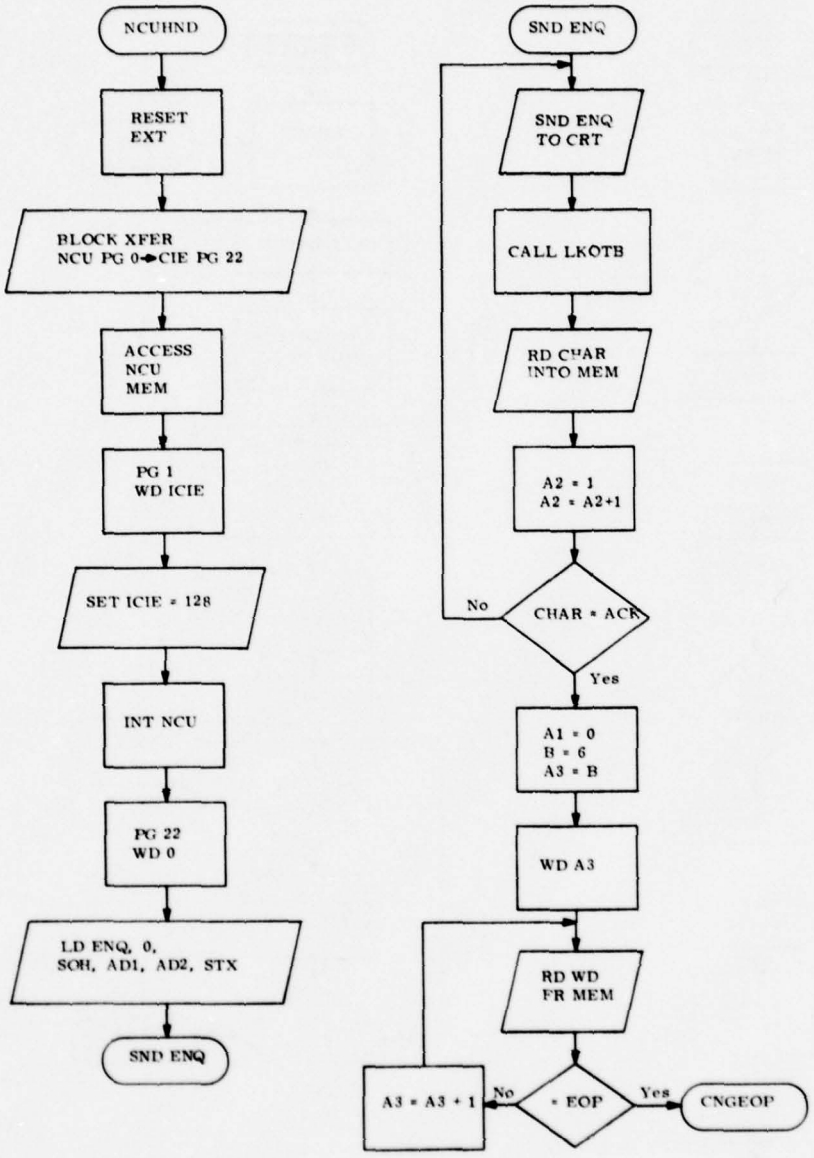


Figure 2-11. (Cont.)

CTCCO (cont.)

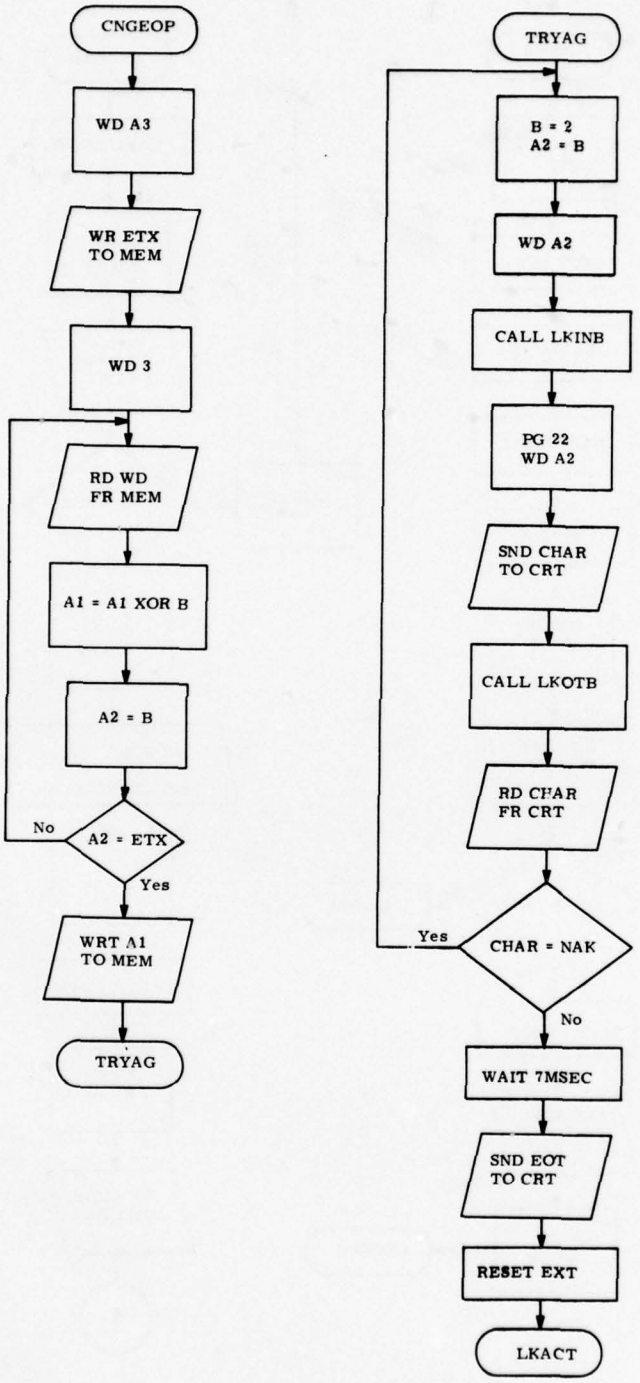


Figure 2-11. (Cont.)

CTCCO (cont.)

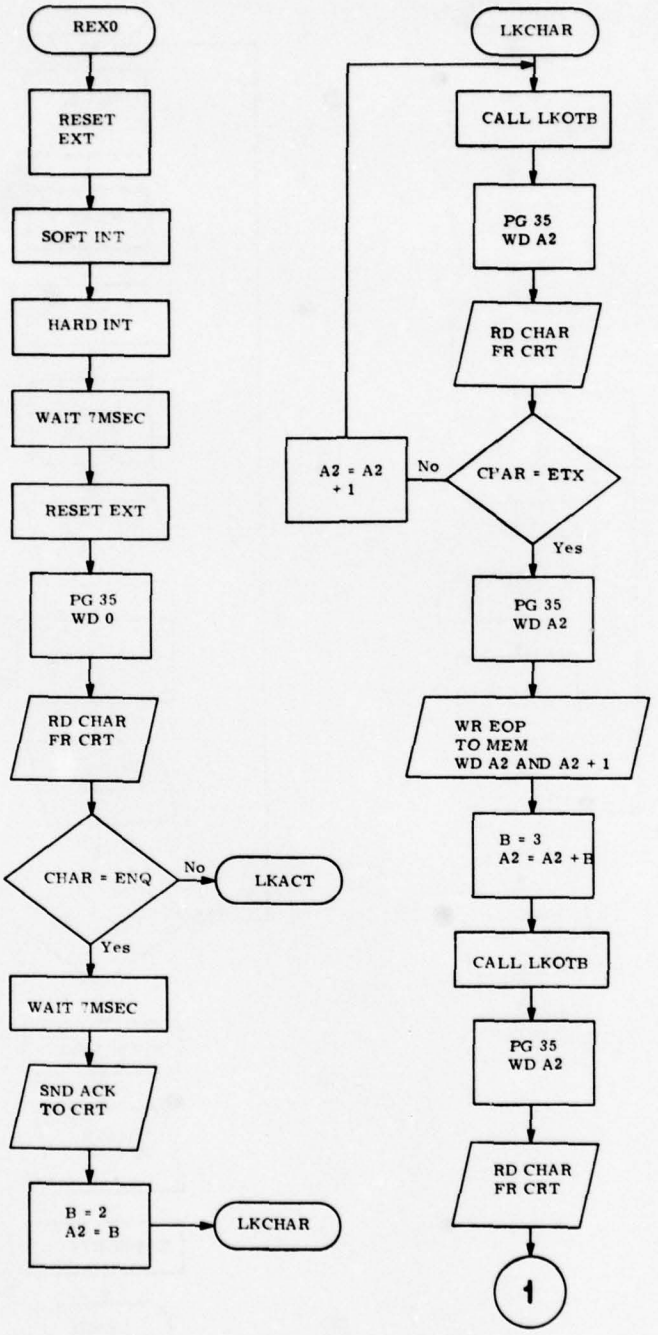


Figure 2-11. (Cont.)

CTCCO (cont.)

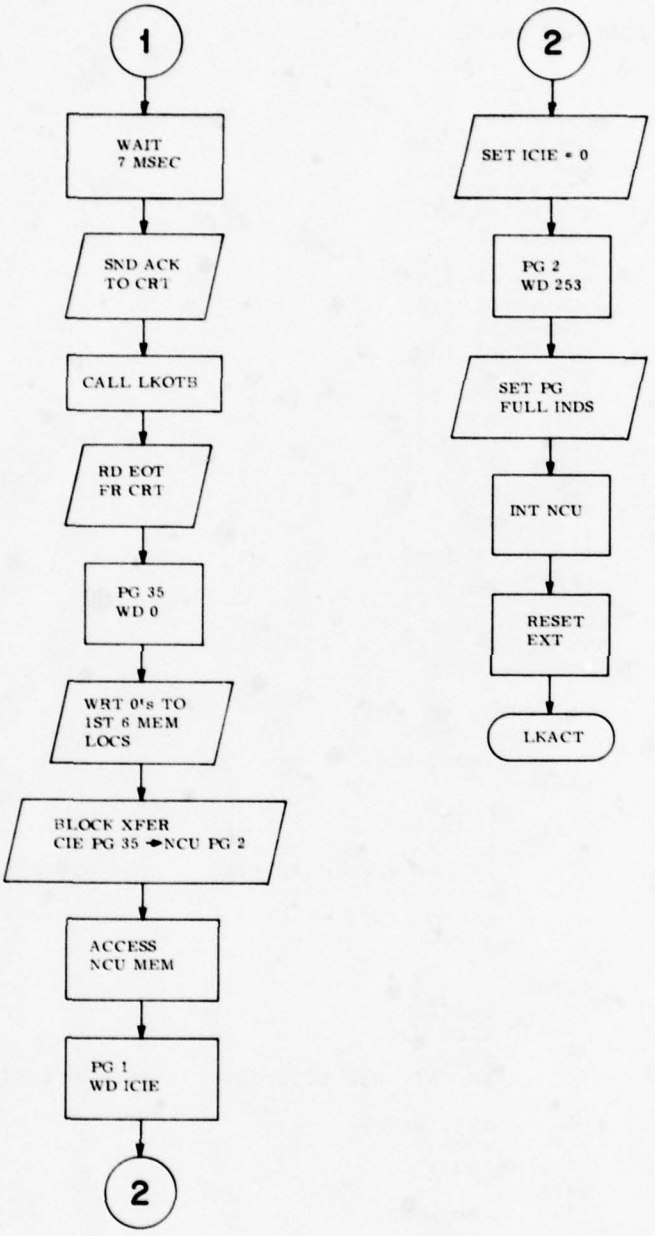


Figure 2-11. (Cont.)

```
 RUN [20,20]MDMPL
PLEASE ENTER INPUT SOURCE FILE NAME
CTCC.DAT
PLEASE ENTER OUTPUT OBJECT FILE NAME
CTCCO.OBJ
WAIT FOR FIRST PASS - SCAN FOR LABELS
  250 RECORDS READ
MPAD     CODE

                        $12BIT
                         PROGRAM CRTDEM.
                         ENQ VALUE 5.
                         ACK VALUE 6.
                         NAK VALUE 149.
                         SOH VALUE 129.
                         AD1 VALUE 255.
                         AD2 VALUE 255.
                         STX VALUE 130.
                         ETX VALUE 3.
                         EOT VALUE 132.
                         ONE VALUE 1.
                         ZERO VALUE 0.
                         PGIN VALUE 22.
                         PGOT VALUE 35.
                         TMPAR VALUE 248.
                         EOP VALUE 255.
                         MAIL VALUE 1.
                         ICIE VALUE 4.
                         RDA VALUE 0.
                         WRA VALUE 1.
                         COUNT VALUE 66.
                         VRDA VALUE 4.
                         VICIE VALUE 128.
                         VWRA VALUE 1.
   0        3
   1      736                      GO TO INIT.
                        *   SUBROUTINES.
                        *   LK AT OUT BUF.
                         LKOTB.
   2       13                      B=ZERO.
   3      141                      BEX0 B=B.
   4      101                      B=B.
   5     2707                      IF LST SKIP ELSE STEP.    OUT BUF FULL?
   6        3
   7       56                      GO TO LKOTB.
  10      657                      JUMP.
                        *
                         LKINB.
  11       13                      B=ZERO.
  12      141                      BEX0 B=B.
  13      101                      B=B.
  14      707                      IF MST SKIP ELSE STEP.    IN BUF EMPTY?
  15        3
  16      236                      GOTO LKINB.
  17      657                      JUMP.
                        *   7 MS WAIT.
                         WT7MS.
  20     7613                       B=TMPAR.
  21      105                       A1=B.
  22     1511                       A2=0.
```

```
                    INLP1.
 23     4211                A2=A2+1.
 24     3707                IF ABT SKIP ELSE STEP.
 25        3
 26      476                GOTO INLP1.
 27     1511                A2=0.
 30     2205                A1=A1+1.
 31     3707                IF ABT SKIP ELSE STEP.
 32        3
 33      476                GOTO INLP1.
 34      657                JUMP.
                    *   INIT MAILBOX PG IN NCU.
                    INIT.
 35      335                OUT3 AMPCR=AMPCR.
 36      335                OUT3 AMPCR=AMPCR.
                    *              WAIT 7 MSEC
 37        3
 40      406                CALL WT7MS.
 41        4                DEV1=0.                          CLEAR.
 42     1521                OUT0=0.
 43      607                STEP.
 44     3004                DEV1=96.                 ACCESS NCU
 45       33                B=MAIL.
 46      125                OUT1=B.
 47       13                B=RDA.
 50      121                OUT0=B.
 51      121                OUT0=B.
 52      113                B=VRDA.
 53      131                OUT2=B.
 54      221                OUT0=1.
 55      221                OUT0=1.
 56       33                B=VWRA.
 57      131                OUT2=B.
 60       53                B=2.
 61      121                OUT0=B.
 62      121                OUT0=B.
 63     3413                B=112.
 64      131                OUT2=B.                          SET WRT ADDR=112
 65      133                B=5.
 66      121                OUT0=B.
 67      121                OUT0=B.
 70       13                B=ZERO.                          SET #ACKS=0
 71      131                OUT2=B.
 72      113                B=ICIE.
 73      121                OUT0=B.
 74      121                OUT0=B.
 75     4013                B=128.
 76      131                OUT2=B.
 77      104                DEV1=4.                  INIT ST REG
100       20                DEV0=1.          SOFT INT-RD
101        4                DEV1=0.
102     1521                OUT0=0.
                    *   LK FOR ACTIVITY.
                    LKACT.
103     7627                IF EXT STEP ELSE SKIP.  INT FROM NCU?
104        3
105     2356                GOTO NCUHND.
106       13                B=ZERO.
107      141                BEX0 B=B.
110      101                B=B
```

```
111     2627                    IF LST STEP ELSE SKIP.  OUT BUF FULL?
112        3
113     7476                    GOTO REXO.              YES
114        3
115     2076                    GOTO LKACT.             NO, KEEP LOOKING
                        NCUHND.
116      335                    OUT3 AMPCR=AMPCR.               RESET EXT
117      335                    OUT3 AMPCR=AMPCR.
120      553                    B=PGIN.                         PGIN
121      125                    OUT1=B.
122     1521                    OUT0=0.
123      607                    STEP.
124     3004                    DEV1=96.                ACCESS NCU
125     1525                    OUT1=0.                 PG 0
126     1521                    OUT0=0.
127     2404                    DEV1=80.                        BLAST NCU-CIE
130     2053                    B=COUNT.                        BLST TIM PAK
131      111                    A2=B.
                        AGAIN.
132     4211                    A2=A2+1.
133     3707                    IF ABT SKIP ELSE STEP.
134        3
135     2656                    GOTO AGAIN.
136       24                    DEV1=1.                 TERM BLAST
137        4                    DEV1=0.
140     1521                    OUT0=0.
141      607                    STEP.
142     3004                    DEV1=96.
                        *               FORCE NCU INTO RD STATE
143       33                     B=MAIL.
144      125                    OUT1=B.
145      113                    B=ICIE.
146      121                     OUT0=B.
147     4013                    B=128.
150      131                    OUT2=B.
151     1521                    OUT0=0.
152       20                    DEV0=1.                 INT NCU
153        4                    DEV1=0.                         CLEAR
154      553                    B=PGIN.                         PGIN
155      125                    OUT1=B.
156     1521                    OUT0=0.
157     1521                    OUT0=0.
                        *   LOAD CRT HDR CHARS
160      133                    B=ENQ.                  ENQ
161      131                    OUT2=B.
162       13                    B=ZERO.                         NULL
163      131                    OUT2=B.
164     4033                    B=SOH.
165      131                    OUT2=B.
166     7773                    B=AD1.
167      131                    OUT2=B.
170     7773                    B=AD2.
171      131                    OUT2=B.
172     4053                    B=STX.
173      131                    OUT2=B.
                        *   WRITE MESS TO CRT
                        *   SEND AN ENQ
                         SNDENQ.
174      553                    B=PGIN.
175      125                    OUT1=B.
```

```
176     1521                    OUT0=0.
177      133                    B=ENQ.
200      131                    OUT2=B.
201     1521                    OUT0=0.
202     4104                    DEV1=132.
                        *                                       SEND CHAR
203     4004                    DEV1=128.
204      221                    OUT0=1.                         SET WD 1
                        *   WAIT FOR AN ACK
205        3
206       46                    CALL LKOTB.
                        *   CK IF ACK RECEIVED
                         RCVACK.
207     4004                    DEV1=128.
210      553                    B=PGIN.
211      125                    OUT1=B.
212     4044                    DEV1=130.                       REC CHAR
213     4064                    DEV1=131.
214     4004                    DEV1=128.
215     2345                    BEX1 A1=A1.
216      607                    STEP.
217      211                    A2=1.
220     4211                    A2=A2+1.                  SET WD PTR
221      115                    A3=B.                      A3=CHAR
222      153                    B=ACK.
223     6415                    A3=A3 EQV B.                    ACK REC?
224     3707                    IF ABT SKIP ELSE STEP.
225        3
226     3716                    GOTO SNDENQ.                    NO, RESEND ENQ
227        4                    DEV1=0.
230     1505                    A1=0.                  INIT A1
231      153                    B=6.
232      115                    A3=B.                  WD PTR
233     6321                    OUT0=A3.
                         LEOP.
234     2305                    A1=A1.
235     2345                    BEX1 A1=A1.
236      111                    A2=B.
237     7773                    B=EOP.
240     4411                    A2=A2 EQV B.
241     3627                    IF ABT STEP ELSE SKIP.  EOP?
242        3
243     5176                    GOTO CNGEOP.            YES
244     6215                    A3=A3+1.                        INCR WD PTR
245        3
246     4716                    GOTO LEOP.
                         CNGEOP.
247     6321                    OUT0=A3.
250       73                    B=ETX.
251      131                    OUT2=B.
252       73                    B=3.
253      121                    OUT0=B.
                        *   CALC BCC
                         BCC.
254     2305                    A1=A1.
255     2345                    BEX1 A1=A1.
256     2505                    A1=A1 XOR B.
257      111                    A2=B.
260       73                    B=ETX.
261     4411                    A2=A2 EQV B.            ETX?
```

```
262     370'                    IF ABT SKIP ELSE STEP.
263       3
264     5316                    GOTO BCC.                       NO
265     2331                    OUT2=A1.                        YES, WRT BCC
                        *   SEND PACKET
                        TRYAG.
266       53                    B=2.
267      111                    A2=B.
270     4321                    OUT0=A2.                        A2=WD PTR
                        PKSND.
271       3
272      226                    CALL LKINB.
273     4004                    DEV1=128.
274      553                    B=PGIN.
275      125                    OUT1=B.
276     4321                    OUT0=A2.
277     4104                    DEV1=132.
300     4004                    DEV1=128.
301     2345                    BEX1 A1=A1.
302      131                    OUT2=B.
303      607                    STEP.
304      115                    A3=B.
305       73                    B=ETX.
306     4211                    A2=A2+1.
307     6415                    A3=A3 EQV B.
310     3707                    IF ABT SKIP ELSE STEP.
311       3
312     5636                    GOTO PKSND.
                        *   SEND BCC
313       3
314      226                    CALL LKINB.
315     4004                    DEV1=128.
316      553                    B=PGIN.
317      125                    OUT1=B.
320     4321                    OUT0=A2.
321     4104                    DEV1=132.
322     4004                    DEV1=128.
                        *               LOOK FOR AN NAK
323       3
324       46                    CALL LKOTB.
325     4004                    DEV1=128.
326      553                    B=PGIN.
327      125                    OUT1=B.
330     1521                    OUT0=0.
331     4044                    DEV1=130.
332     4064                    DEV1=131.
333     4004                    DEV1=128.
334     2345                    BEX1 A1=A1.
335      607                    STEP.
336      115                    A3=B.
337     4533                    B=NAK.
340     6415                    A3=A3 EQV B.
341     3627                    IF ABT STEP ELSE SKIP.  =NAK?
342       3
343     5556                    GOTO TRYAG.             YES, RESEND PACK
                        *   YES, SEND EOT
344       3
345      406                    CALL WT7MS.             WAIT 7 MSEC
346     4004                    DEV1=128.
347      553                    B=PGIN.
```

```
350      125                    OUT1=B.
351     1521                    OUT0=0.
352     4113                    B=EOT.
353      131                    OUT2=B.
354     1521                    OUT0=0.
355     4104                    DEV1=132.                    SEND EOT
356     4004                    DEV1=128.
357      335                    OUT3 AMPCR=AMPCR.            RESET EXT
360      335                    OUT3 AMPCR=AMPCR.
361        3
362     2076                    GOTO LKACT.          RETURN
                       REXO.
363      335                    OUT3 AMPCR=AMPCR.    RESER EXT
364      335                    OUT3 AMPCR=AMPCR.
365       20                    DEV0=1.                      SOFT INT
366       34                    DEV3=1.                      HRD INT
367        3
370      406                     CALL WT7MS.         SYNCH WAIT
371      335                    OUT3 AMPCR=AMPCR.            RSET EXT
372      335                    OUT3 AMPCR=AMPCR.
                       *              RD PACKET FROM CRT
373     4004                    DEV1=128.
374     1073                    B=PGOT.
375      125                    OUT1=B.
376     1521                     OUT0=0.
377     4044                    DEV1=130.
400     4064                     DEV1=131.
401     4004                     DEV1=128.
402     2345                    BEX1 A1=A1.
403      607                     STEP.
404      105                      A1=B.
405      133                    B=ENQ.
406     2405                     A1=A1 EQV B.
407     3707                    IF ABT SKIP ELSE STEP.  =ENQ?
410        3
411     2076                     GOTO LKACT.          NO, GO BACK
                       *              YES, SEND ACK AFTER 7 MSEC
412        3
413      406                    CALL WT7MS.
414     4004                      DEV1=128.
415     1073                     B=PGOT.
416      125                    OUT1=B.
417      221                    OUT0=1.
420      153                    B=ACK.
421      131                    OUT2=B.
422     4104                      DEV1=132.
423     4004                     DEV1=128.
424       53                     B=2.
425      111                    A2=B.                        A2=WD PTR
                       *              READ PACKET FROM CRT
                        LKCHAR.
426        3
427       46                    CALL LKOTB.
430     4004                    DEV1=128.
431     1073                    B=PGOT.
432      125                     OUT1=B.
433     4321                    OUT0=A2.
434     4044                    DEV1=130.
435     4064                     DEV1=131.
436     4004                    DEV1=128.
```

```
437     2345                    BEX1 A1=A1.
440      607                    STEP.
441      115                   A3=B.
442       73                    B=ETX.
443     6415                    A3=A3 EQV B.
444     3627                     IF ABT STEP ELSE SKIP.        =ETX?
445       23
446     1256                   GOTO CHETX.              YES, CHANGE ETX
447     4211                    A2=A2+1.                      NO, INCR WD PTR
450       23
451      556                   GOTO LKCHAR.
                      CHETX.
452        4                   DEV1=0.
453     1073                   B=PGOT.
454      125                   OUT1=B.
455     7773                   B=EOP.
456     4321                    OUT0=A2.
457      131                    OUT2=B.
460     4211                   A2=A2+1.
461     4321                   OUT0=A2.
462      131                    OUT2=B.
463       73                    B=3.
464     4111                   A2=A2+B.
                      *               RD BCC
465        3
466       46                     CALL LKOTB.
467     4004                   DEV1=128.
470     1073                   B=PGOT.
471      125                   OUT1=B.
472     4321                    OUT0=A2.
473     4044                   DEV1=130.
474     4064                   DEV1=131.
475     4004                   DEV1=128.
476     2345                   BEX1 A1=A1.
                      *               SEND ACK AFTER 7 MSEC
477        3
500      406                   CALL WT7MS.
501     4004                   DEV1=128.
502     1073                   B=PGOT.
503      125                   OUT1=B.
504     1521                   OUT0=0.
505      153                   B=ACK.
506      131                   OUT2=B.
507     4104                    DEV1=132.
510     4004                    DEV1=128.
                      *               READ EOT
511        3
512       46                   CALL LKOTB.
513     4004                   DEV1=128.
514     1073                   B=PGOT.
515     1521                   OUT0=0.
516     4044                    DEV1=130.
517     4064                    DEV1=131.
520     4004                   DEV1=128.
521     2345                   BEX1 A1=A1.
522     1521                   OUT0=0.
                      *               DELETE AD1, AD2
523        4                   DEV1=0.
524     1073                   B=PGOT.
525      125                   OUT1=B.
```

```
526     1521                    OUT0=0.
527       13                    B=ZERO.
530      131                    OUT2=B.
531      607                    STEP.
532      131                    OUT2=B.
533      607                    STEP.
534      131                    OUT2=B.
535      607                     STEP.
536      131                    OUT2=B.
537      607                    STEP.
540      131                    OUT2=B.
541      607                    STEP.
542      131                    OUT2=B.
543        4                    DEV1=0.
544     1521                    OUT0=0.
545      607                    STEP.
546     3004                    DEV1=96.
547       53                    B=2.                    PG 2
550      125                    OUT1=B.
551     1521                     OUT0=0.
552     1521                    OUT0=0.
553     3204                    DEV1=104.                       BLAST CIE-NCU
554     2053                     B=66.                  BLAST TM PAR
555      111                    A2=B.
                HLDAG.
556     4211                    A2=A2+1.
557     3707                    IF ABT SKIP ELSE STEP.
560       23
561     3356                     GOTO HLDAG.
562        4                    DEV1=0.
563     1521                     OUT0=0.
564      607                    STEP.
                *               FORCE NCU. INTO WRITE STATE
565     3004                    DEV1=96.
566       33                    B=MAIL.                         PG 1 OF NCU
567      125                    OUT1=B.
570      113                    B=ICIE.
571      121                    OUT0=B.
572      121                    OUT0=B.
573       13                     B=ZERO.
574      131                    OUT2=B.
575       53                    B=2.
576      125                    OUT1=B.
577     7733                    B=253.
600      121                    OUT0=B.
601      121                    OUT0=B.
602     7773                    B=255.
603      131                    OUT2=B.
604     7753                     B=254.
605      121                   OUT0=B.
606      121                    OUT0=B.
607     7773                     B=255.
610      131                    OUT2=B.
611       20                    DEV0=1.                 INT NCU-WTITE .
612      607                    STEP.
613        4                    DEV1=0.                 CLEAR
614     1521                    OUT0=0.
615      335                    OUT3 AMPCR=AMPCR.               RESET EXT
616      335                    OUT3 AMPCR=AMPCR.               RESET EXT
617        3
```

```
  620     2076                    GOTO LKACT.
                                  END?.

THE NUMBER OF ERRORS= 0
TT1  --  STOP
>
```

CTCGO

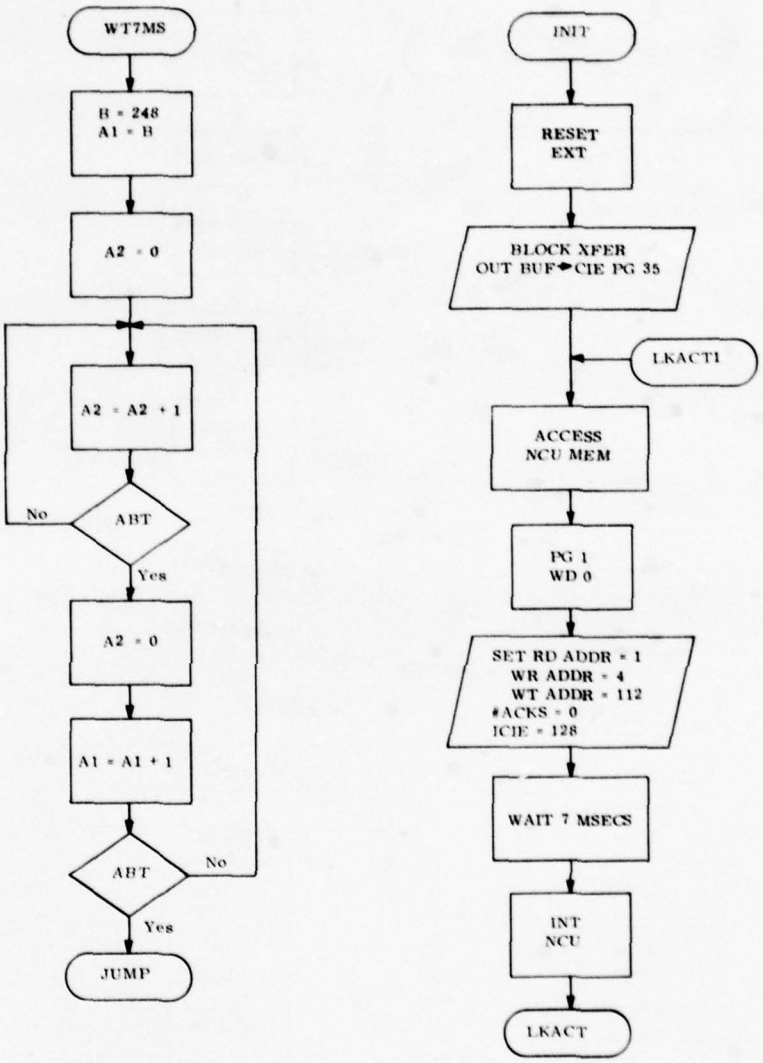


Figure 2-12. CTCGO

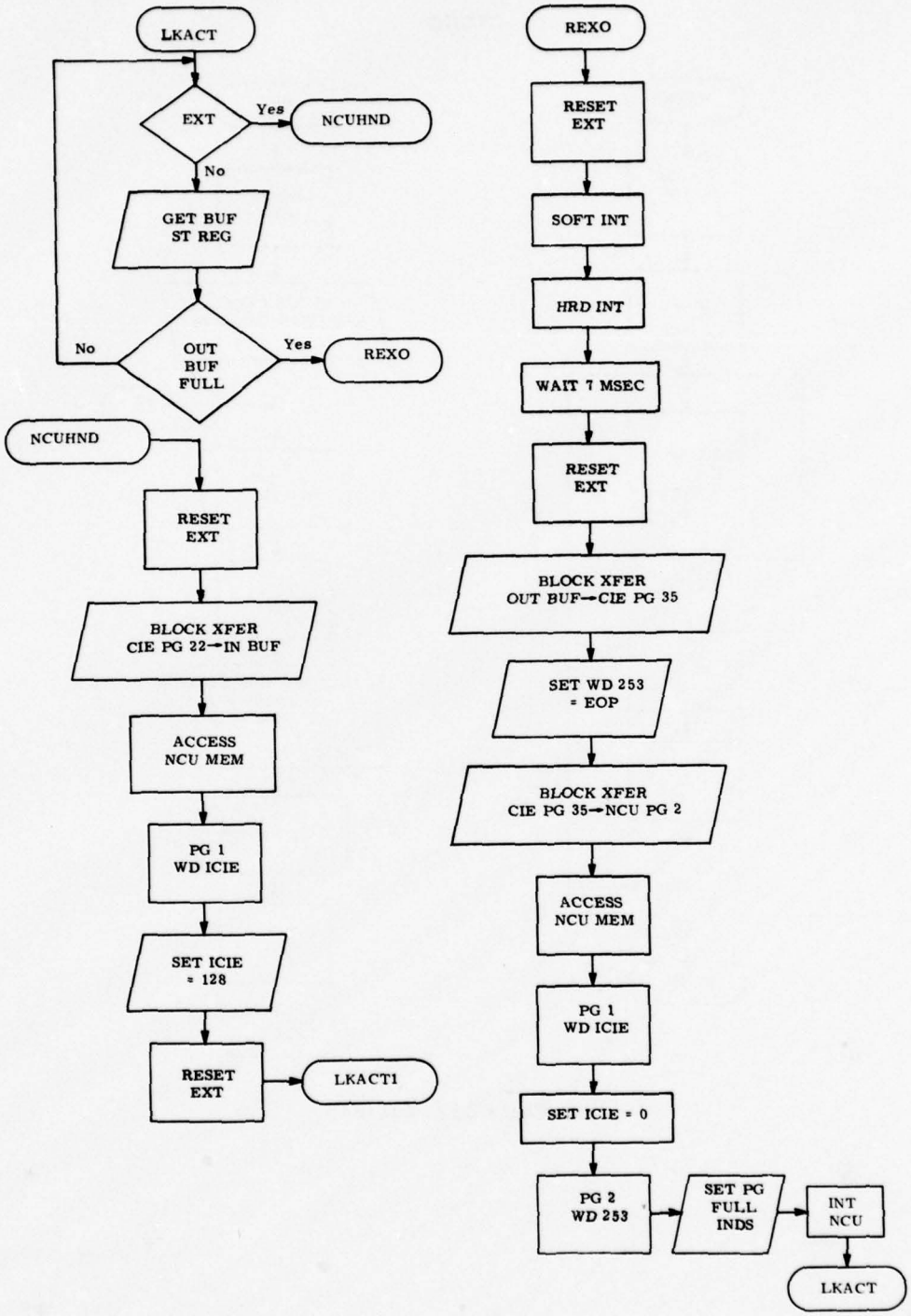


Figure 2-12. (Cont.)

```
MCR>RUN [20,20]MDMPL
PLEASE ENTER INPUT SOURCE FILE NAME
CTCG.DAT
PLEASE ENTER OUTPUT OBJECT FILE NAME
CTCGO.OBJ
WAIT FOR FIRST PASS - SCAN FOR LABELS
MPAD     CODE

                        $12BIT
                         PROGRAM-ID HSTDEM.
                         ZERO VALUE 0.
                         ONE VALUE 1.
                         PGIN VALUE 22.
                         PGOT VALUE 35.
                         COUNT VALUE 66.
                         MAIL VALUE 1.
                         ICIE VALUE 4.
                         RDA VALUE 0.
                         WRA VALUE 1.
                         VICIE VALUE 128.
                         VRDA VALUE 1.
                         VWRA VALUE 4.
                         TMPAR VALUE 248.
    0        3
    1      376                      GOTO INIT.
                         WT7MS.
    2     7613                      B=TMPAR.
    3      105                      A1=B.
    4     1511                      A2=0.
                         INLP1.
    5     4211                      A2=A2+1.
    6     3707                      IF ABT SKIP ELSE STEP.
    7        3
   10      136                      GOTO INLP1.
   11     1511                      A2=0.
   12     2205                      A1=A1+1.
   13     3707                      IF ABT SKIP ELSE STEP.
   14        3
   15      136                      GOTO INLP1.
   16      657                      JUMP.
                         INIT.
                        *                  INIT NCU MAILBOX PAGE
   17      335                      OUT3 AMPCR=AMPCR.
   20      335                      OUT3 AMPCR=AMPCR.
   21        4                      DEV1=0.
                        *                  FAKE BLAST FOR INIT
   22     4351                      BEX2 A2=A2.
   23     1073                      B=PGOT.
   24      125                      OUT1=B.
   25     1521                      OUT0=0.
   26       44                      DEV1=2.
   27     2053                      B=COUNT.
                         LP6.
   30        1                      B=B+1.
   31     3707                      IF ABT SKIP ELSE STEP.
   32        3
   33      616                      GOTO LP6.
   34       24                      DEV1=1.
   35      607                      STEP.
   36     4351                      BEX2 A2=A2.
```

```
                    LKACT1.
 37        4                 DEV1=0.                          CLEAR
 40     1521                 OUT0=0.
 41      607                 STEP.
 42     3004                   DEV1=96.                       ACCESS NCU
 43       33                  B=MAIL.
 44      125                 OUT1=B.
 45       13                  B=RDA.
 46      121                 OUT0=B.
 47       33                  B=VRDA.
 50      131                 OUT2=B.
 51      221                 OUT0=1.                FORCE ADDR
 52      221                 OUT0=1.
 53      113                 B=VWRA.
 54      131                 OUT2=B.
 55       53                 B=2.
 56      121                 OUT0=B.
 57      121                 OUT0=B.
 60     3413                 B=112.
 61      131                  OUT2=B.               SET WT ADDR=112
 62      133                 B=5.
 63      121                 OUT0=B.
 64      121                 OUT0=B.
 65       13                 B=ZERO.                SET #ACKS=0
 66      131                 OUT2=B.
 67      113                 B=ICIE.
 70      121                 OUT0=B.
 71     4013                 B=VICIE.
 72      131                 OUT2=B.
 73        3
 74       46                 CALL WT7MS.
 75       20                 DEV0=1.                          INT NCU-RD
 76        4                  DEV1=0.
 77     1521                 OUT0=0.
                   *              LK FOR ACTIVITY
                    LKACT.
100     7627                 IF EXT STEP ELSE SKIP. INT FROM NCU?
101        3
102     2276                   GOTO NCUHND.
103       13                 B=ZERO.
104      141                 BEXO B=B.
105      101                   B=B.
106     2627                 IF LST STEP ELSE SKIP. OUT BUF FULL?
107        3
110     3656                  GOTO REXO.              YES
111        3
112     2016                  GOTO LKACT.             NO, KEEP LOOKING
                    NCUHND.
113      335                 OUT3 AMPCR=AMPCR.
114      335                  OUT3 AMPCR=AMPCR.
115        4                 DEV1=0.
116      553                  B=PGIN.
117      125                   OUT1=B.
120     1521                 OUT0=0.
121     1521                 OUT0=0.
122     3004                 DEV1=96.
123     1525                 OUT1=0.
124     1521                 OUT0=0.
125     1521                 OUT0=0.
126     2404                 DEV1=80.
```

```
127     2053                    B=COUNT.
                        LP1.
130        1                    B=B+1.
131     3707                    IF ABT SKIP ELSE STEP.
132        3
133     2616                    GOTO LP1.
134       24                    DEV1=1.
                        *               BLAST TO PDP-11 INT
135        4                    DEV1=0.
136       30                    DEV2=1.                 RESET CTR
137      553                    B=PGIN.
140      125                     OUT1=B.
141     1521                     OUT0=0.
142      104                    DEV1=4.
143     2053                    B=COUNT.
                        LP2.
144        1                    B=B+1.
145     3707                    IF ABT SKIP ELSE STEP.
146        3
147     3116                    GOTO LP2.
150       24                      DEV1=1.
151      607                    STEP.
152       30                    DEV2=1.                         SEND STATUS
153        4                     DEV1=0.                        CLEAR
154     1521                     OUT0=0.
155      607                     STEP.
                        *               FORCE NCU INTO READ STATE
156     3004                    DEV1=96.
157       33                    B=MAIL.
160      125                    OUT1=B.
161      113                    B=ICIE.
162      121                    OUT0=B.
163     4013                    B=12B.
164      131                    OUT2=B.
165      607                    STEP.
166      335                     OUT3 AMPCR=AMPCR.      RESET EXT
167      335                    OUT3 AMPCR=AMPCR.
170        3
171      776                     GOTO LKACT1.
                        *               BLAST EXO-CIE-NCU
                        REXO.
172      335                    OUT3 AMPCR=AMPCR.
173      335                    OUT3 AMPCR=AMPCR.
174       20                    DEV0=1.                         SOFT INT
175       34                    DEV3=1.                         HRD INT
176        3
177       46                    CALL WT7MS.             SYNCH WAIT
200      335                    OUT3 AMPCR=AMPCR.               RESET EXT
201      335                    OUT3 AMPCR=AMPCR.
202        4                    DEV1=0.                 CLEAR
203     4351                    BEX2 A2=A2.
204     1073                    B=PGOT.
205      125                     OUT1=B.
206     1521                      OUT0=0.
207       44                    DEV1=2.
210     2053                    B=COUNT.
                        LP3.
211        1                    B=B+1.
212     3707                    IF ABT SKIP ELSE STEP.
213        3
```

```
 214     4236                    GOTO LP3.
 215       24                     DEV1=1.
 216      607                    STEP.           FOR GATEWAY
 217     4351                    BEX2 A2=A2.
                    *                 SET WD 253=EOP
 220        4                    DEV1=0.
 221     7733                    B=253.
 222      121                    OUT0=B.
 223     7773                    B=255.
 224      131                    OUT2=B.
 225     1521                    OUT0=0.
 226      607                    STEP.
 227     3004                     DEV1=96.
 230       53                     B=2.
 231      125                     OUT1=B.
 232     1521                     OUT0=0.
 233     1521                    OUT0=0.
 234     3204                    DEV1=104.
 235     2053                    B=COUNT.
                          LP4.
 236        1                    B=B+1.
 237     3707                    IF ABT SKIP ELSE STEP.
 240        3
 241     4756                    GOTO LP4.
 242        4                     DEV1=0.
 243     1521                     OUT0=0.
 244      607                    STEP.
 245     3004                    DEV1=96.
 246       33                    B=MAIL.
 247      125                     OUT1=B.
 250      113                      B=ICIE.
 251      121                    OUT0=B.
 252      121                    OUT0=B.
 253       13                    B=ZERO.
 254      131                    OUT2=B.
 255       53                    B=2.
 256      125                    OUT1=B.
 257     7733                    B=253.
 260      121                    OUT0=B.
 261     7773                     B=255.
 262      131                    OUT2=B.
 263      607                    STEP.
 264      131                    OUT2=B.                    SET OUT PG FULL
 265     1521                    OUT0=0.
 266      607                    STEP.
 267        4                    DEV1=0.
 270     1521                    OUT0=0.
 271      607                     STEP.
 272       20                    DEV0=1.                    INT NCU
 273        3
 274     2016                     GOTO LKACT.
                                  END?.

THE NUMBER OF ERRORS= 0
TTO --  STOP
>
```

```
 RUN [20,20]MDMPL
PLEASE ENTER INPUT SOURCE FILE NAME
GTBA.DAT
PLEASE ENTER OUTPUT OBJECT FILE NAME
GTBOA.OBJ
WAIT FOR FIRST PASS - SCAN FOR LABELS
MPAD      CODE

                          $12BIT
                           PROGRAM-ID GTDB.
                           ZERO VALUE 0.
                           COUNT VALUE 66.
                          *              PUT STEPS HERE FOR WRITER
   0        3
   1     1256                   GOTO RDR.                        FOR READER
   2        4                   DEV1=0.
   3       13                   B=ZERO.
   4      125                    OUT1=B.
   5       13                   B=ZERO.
   6      121                    OUT0=B.
   7       13                   B=ZERO.
  10      131                    OUT2=B.
                          SEVN.
  11        1                     B=B+1.
  12      131                    OUT2=B.
  13      607                   STEP.
  14      101                   B=B.
  15     3707                     IF ABT SKIP ELSE STEP.
  16        3
  17      236                       GO TO SEVN.
  20        4                   DEV1=0.
  21       30                   DEV2=1.
  22      607                   STEP.
  23       13                   B=ZERO.
  24      125                   OUT1=B.
  25       13                   B=ZERO.
  26      121                      OUT0=B.
  27      104                   DEV1=4.                  CIE-EXO
  30     2053                   B=COUNT.
                          AGA1.
  31        1                   B=B+1.
  32     3707                   IF ABT SKIP ELSE STEP.
  33        3
  34      636                   GOTO AGA1.
  35       24                     DEV1=1.
  36      607                        STEP.
  37       30                   DEV2=1.                  SND STATUS
                          HNG3.
  40        3
  41     1016                      GOTO HNG3.
  42     1501                      B=0.       PG
  43      125                      OUT1=B.
  44     1501                       B=0.      WD
  45      121                      OUT0=B.
  46        4                       DEV1=0.
                          REED.
  47     2345                       BEX1 A1=A1.      READ
  50        3
  51     1176                       GO TO REED.
                          *              GATEWAY TO CIE
```

```
                        RDR.                    READER
  52        4                 DEV1=0.
  53     4351                 BEX2 A2=A2.
  54      201                 B=1.
  55      125                   OUT1=B.
  56       13                 B=ZERO.
  57      121                 OUT0=B.                 SET WD
  60       44                  DEV1=2.                BLAST TO CIE
  61     2053                 B=COUNT.
                        AGA2.
  62        1                 B=B+1.
  63     3707                 IF ABT SKIP ELSE STEP.
  64        3
  65     1456                 GOTO AGA2.
  66       24                 DEV1=1.                 TERM BLAST
  67      607                 STEP.
  70     4351                 BEX2 A2=A2.     SEND STATUS
  71        4                 DEV1=0.
  72     1521                 OUT0=0.
  73      607                 STEP.
                        *               READ RESULT
  74      201                 B=1.            PG 1
  75      125                 OUT1=B.
  76     1501                 B=0.            WD 0
  77      121                 OUT0=B.
 100     1511                 A2=0.
                        RDRES.
 101     2305                 A1=A1.
 102     2345                  BEX1 A1=A1.    READ FR CIE
 103     4401                 B=A2 EQV B.
 104     3707                 IF ABT SKIP ELSE STEP.
 105        3
 106     2336                 GOTO ERROR.
 107     4211                  A2=A2+1.
 110     3707                  IF ABT SKIP ELSE STEP.
 111        3
 112     2036                 GOTO RDRES.     REPEAT
                        NOERR.
 113        3
 114     2276                 GOTO NOERR.
                        ERROR.
 115        3
 116     2336                 GOTO ERROR.             ERROR COND
 117     4301                 B=A2.
 120      607                 STEP.
 121     4321                 OUT0=A2.
                        RDRES1.
 122     2305                  A1=A1.
 123     2345                 BEX1 A1=A1.
 124      607                 STEP.
 125        3
 126     2456                 GOTO RDRES1.
                              END?.
THE NUMBER OF ERRORS= 0
TTO  --  STOP
>
```

CRTOBJ

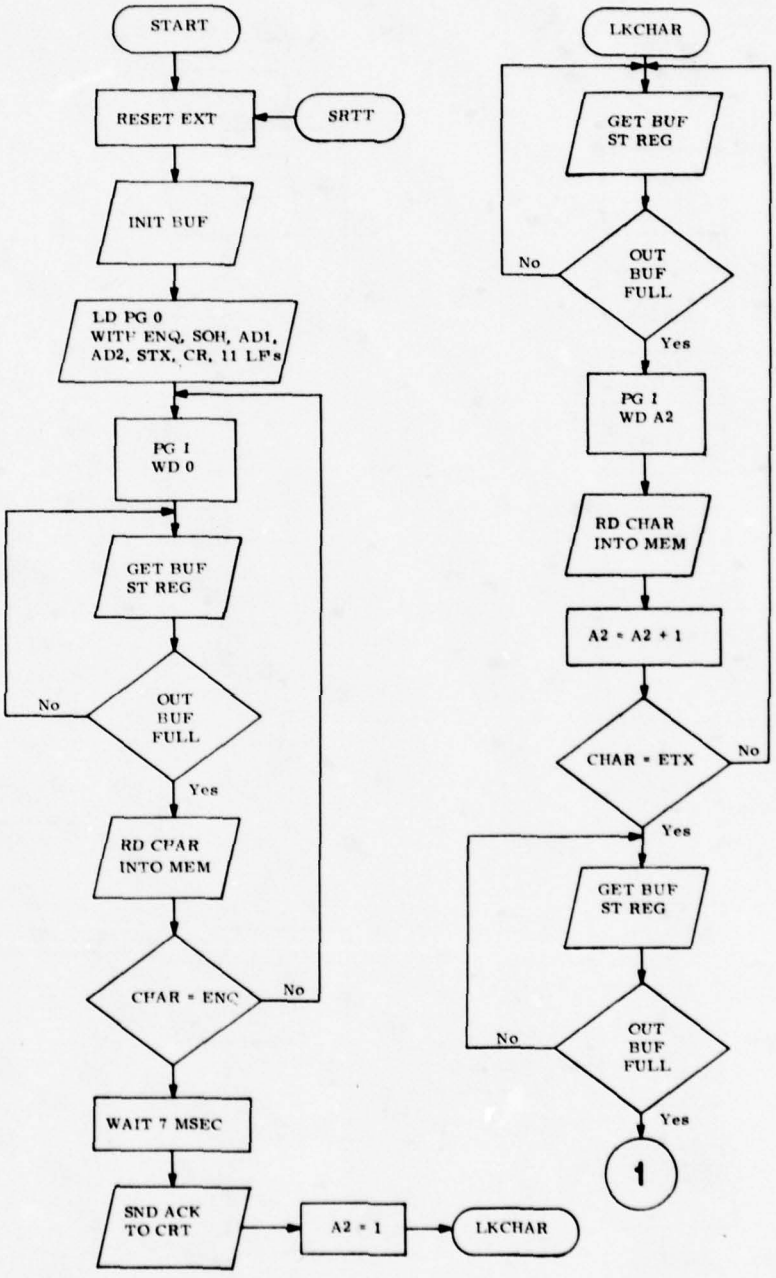


Figure 2-13. CRTOBJ

CRTOBJ (cont.)

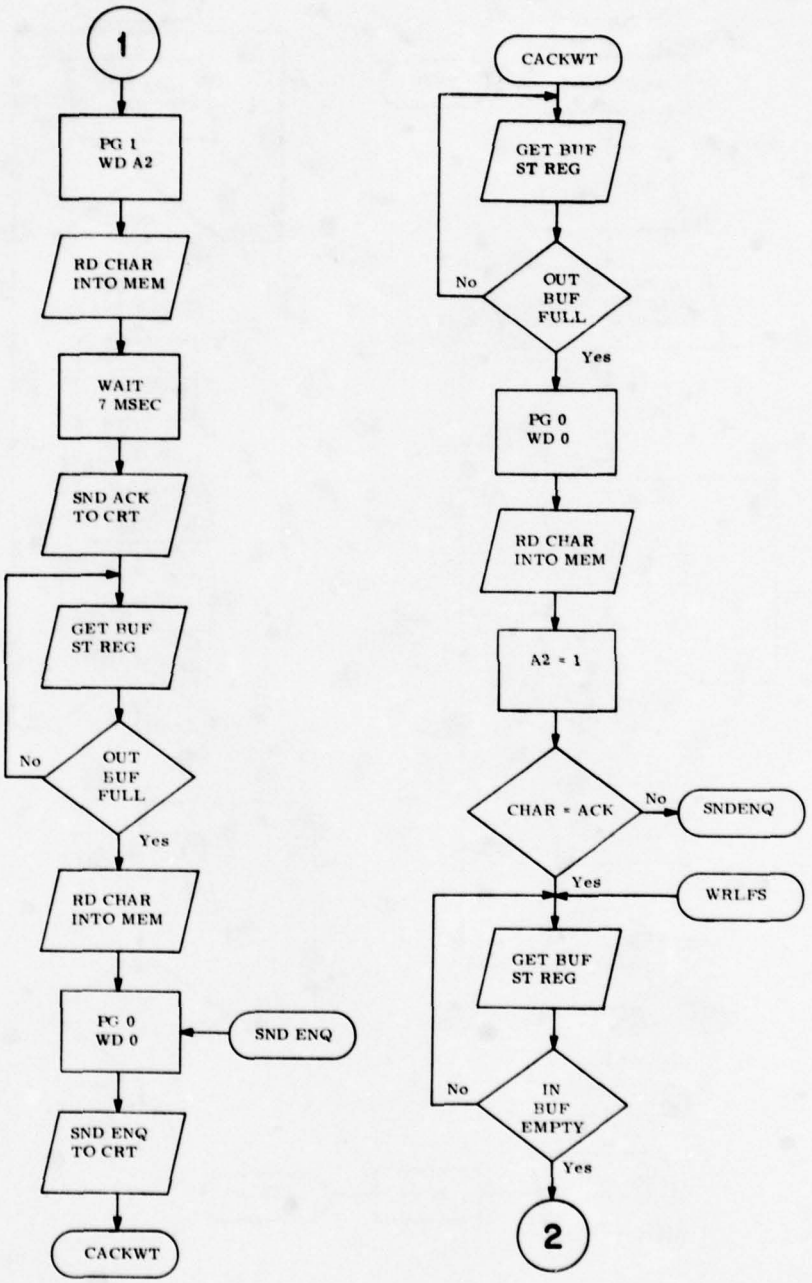


Figure 2-13. (Cont.)

CRTOBJ (cont.)

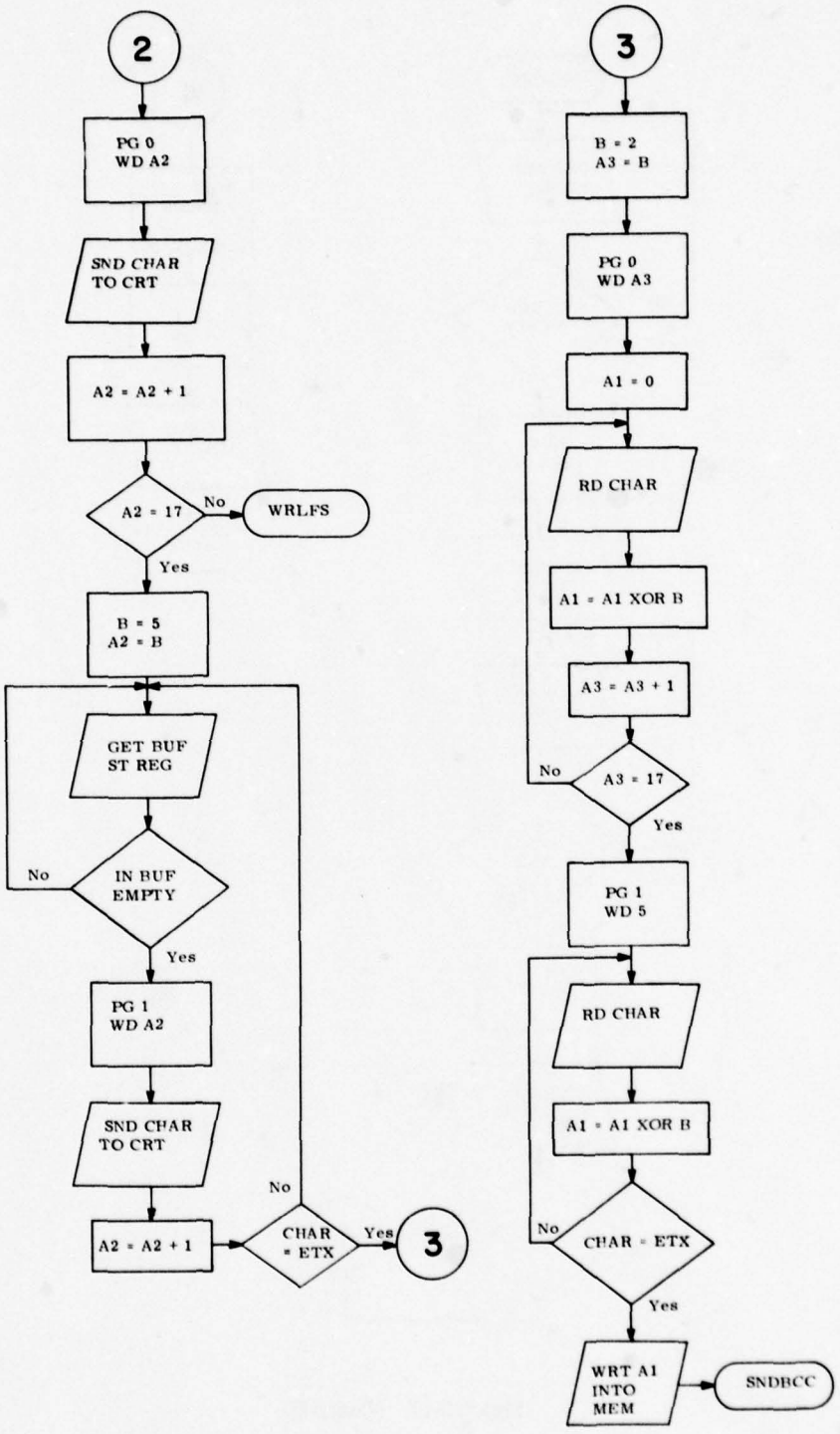


Figure 2-13. (Cont.)

CRTOBJ (cont.)

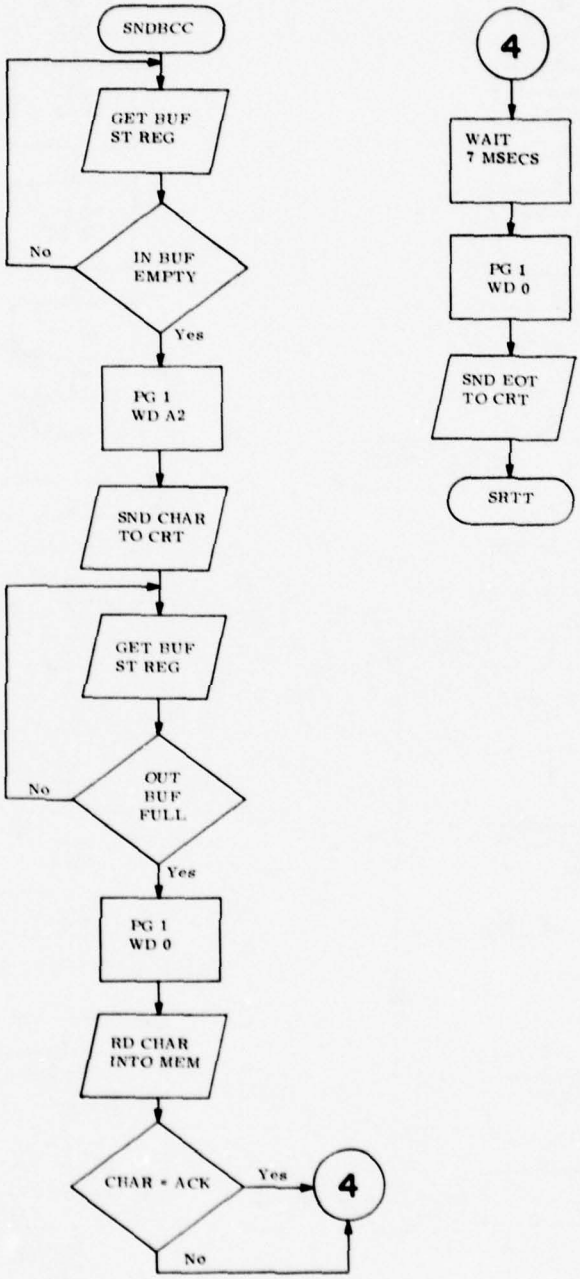


Figure 2-13. (Cont.)

```
MCR>RUN [20,20]MDMPL
PLEASE ENTER INPUT SOURCE FILE NAME
CRTCK.DAT
PLEASE ENTER OUTPUT OBJECT FILE NAME
CRTOBJ.OBJ
WAIT FOR FIRST PASS - SCAN FOR LABELS
  250 RECORDS READ
MPAD     CODE

                        $12BIT
                         PROGRAM-ID CRTCK.
                        *         CRT DEMO INTERFACE PROGRAM
                        *         READ A PACKET FROM CRT.
                        *         DO 8 LFS, SEND BACK THE PACKET
                         ENQ VALUE 5.
                         ACK VALUE 6.
                         NAK VALUE 149.
                         SOH VALUE 129.
                         AD1 VALUE 255.
                         AD2 VALUE 255.
                         XMN VALUE 0.
                         STX VALUE 130.
                         ETX VALUE 3.
                         EOT VALUE 132.
                         LF VALUE 10.
                         CR VALUE 141.
                         ONE VALUE 1.
                         ZERO VALUE 0.
                         CONPG VALUE 0.
                         CPG VALUE 1.
                         TMPAR VALUE 248.
                         CHA VALUE 65.
                        $         INITIALIZE CONTROL CHAR PG CONPG
                         SRTT.
   0      335                    OUT3 AMPCR=AMPCR.
   1      335                    OUT3 AMPCR=AMPCR.
   2      104                    DEV1=4.                    CLEAR
   3        4                    DEV1=0.                    CONPG
   4       13                    B=CONPG.
   5      125                    OUT1=B.
   6     1521                    OUT0=0.                    WD 0
   7      133                    B=ENQ.                     ENQ
  10      131                    OUT2=B.
  11     4033                    B=SOH.                     SOH
  12      131                    OUT2=B.
  13     7773                    B=AD1.                     AD1
  14      131                    OUT2=B.
  15     7773                    B=AD2.                     AD2
  16      131                    OUT2=B.
  17     4053                    B=STX.                     STX
  20      131                    OUT2=B.
  21     4333                    B=CR.                      CR
  22      131                    OUT2=B.
  23     7513                    B=244.
  24      105                    A1=B.                      WRITE 11 LFS
                         LDLF.                             LAST LF AT LOC 16
  25      253                    B=LF.
  26      131                    OUT2=B.
  27     2205                    A1=A1+1.
  30     3707                    IF ABT SKIP ELSE STEP.
```

```
 31        3
 32      536                GOTO LDLF.
                     *       READ PACKET FROM CRT
                      RPAC.
 33     4004                DEV1=128.
 34       33                B=CPG.                    PG CPG
 35      125                OUT1=B.
 36     1521                OUT0=0.                   WD 0
                      WTENQ.                          WAIT FOR ENQ
 37       13                B =ZERO.
 40      141                BEX0 B=B.                 GET BUF ST REG
 41      101                B=B.
 42     2707                IF LST SKIP ELSE STEP.    OUT BUF FULL?
 43        3
 44      776                GOTO WTENQ.               NO
 45     4044                DEV1=130.                 REC CHAR
 46     4064                DEV1=131.
 47     4004                DEV1=128.
 50     2345                BEX1 A1=A1.
 51      607                STEP.
 52      105                A1=B.                     A1=CHAR
 53      133                B=ENQ.
 54     2405                A1=A1 EQV B.
 55     3707                IF ABT SKIP ELSE STEP.    CHAR=ENQ?
 56        3
 57      676                GOTO RPAC.                NO,READ AGAIN
                     *       WAIT 7 MSEC BEFORE SENDING ACK
 60     7613                B=TMPAR.
 61      105                A1=B.
 62     1511                A2=0.
                      INLP1.
 63     4211                A2=A2+1.
 64     3707                IF ABT SKIP ELSE STEP.
 65        3
 66     1476                GOTO INLP1.
 67     1511                A2=0.
 70     2205                A1=A1+1.
 71     3707                IF ABT SKIP ELSE STEP.
 72        3
 73     1476                GOTO INLP1.
 74     4004                DEV1=128.
 75       33                B=CPG.
 76      125                OUT1=B.
 77     1521                OUT0=0.                    YES, SEND ACK
100      153                B=ACK.
101      131                OUT2=B.
102     4104                DEV1=132.                  SEND CHAR
103     4004                DEV1=128.
104      211                A2=1.                      WD PTR
                      LKCHAR.
105       13                B=ZERO.
106      141                BEX0 B=B.                  GET BUF ST REG
107      101                B=B.
110     2707                IF LST SKIP ELSE STEP.    OUT BUF FULL?
111        3
112     2136                GOTO LKCHAR.                 NO
113     4004                DEV1=128.
114       33                B=CPG.
115      125                OUT1=B.
116     4321                OUT0=A2.                   YES, READ CHAR
```

```
117     4044                    DEV1=130.               REC CHAR
120     4064                    DEV1=131.
121     4004                    DEV1=128.
122     2345                    BEX1 A1=A1.             GET WD
123      607                    STEP.
124      115                    A3=B.
125       73                    B=ETX.
126     4211                    A2=A2+1.                 INCR WD PTR
127     6415                    A3=A3 EQV B.
130     3707                    IF ABT SKIP ELSE STEP.  =ETX?
131        3
132     2136                    GOTO LKCHAR.            NO
                        *        YES, READ BCC
                         RDBCC.
133       13                    B=ZERO.
134      141                    BEXO B=B.
135      101                    B=B.
136     2707                    IF LST SKIP ELSE STEP.  OUT BUF FULL?
137        3
140     2676                    GOTO RDBCC.             NO
141     4004                    DEV1=128.
142       33                    B=CPG.
143      125                    OUT1=B.
144     4321                    OUT0=A2.
145     4044                    DEV1=130.               REC CHAR
146     4064                    DEV1=131.
147     4004                    DEV1=128.
150     2345                    BEX1 A1=A1.
                        *        WAIT 7 MSEC BEFORE SENDING ACK
151     7613                    B=TMPAR.
152      105                    A1=B.
153     1511                    A2=0.
                         INLP2.
154     4211                    A2=A2+1.
155     3707                    IF ABT SKIP ELSE STEP.
156        3
157     3316                    GOTO INLP2.
160     1511                    A2=0.
161     2205                    A1=A1+1.
162     3707                    IF ABT SKIP ELSE STEP.
163        3
164     3316                    GOTO INLP2.
165     4004                    DEV1=128.
166       33                    B=CPG.
167      125                    OUT1=B.
170     1521                    OUT0=0.                  YES,SEND ACK
171      153                    B=ACK.
172      131                    OUT2=B.
173     4104                    DEV1=132.               SEND CHAR
174     4004                    DEV1=128.
                        *        READ EOT
                         LKEOT.
175       13                    B=ZERO.
176      141                    BEXO B=B.                GET BUF ST REG
177      101                    B=B.
200     2707                    IF LST SKIP ELSE STEP.  OUT BUF FULL?
201        3
202     3736                    GOTO LKEOT.              NO
203     4004                    DEV1=128.
204       33                    B=CPG.
```

```
205     125                     OUT1=B.
206    1521                     OUT0=0.                    YES, READ EOT
207    4044                     DEV1=130.                   REC CHAR
210    4064                     DEV1=131.
211    4004                     DEV1=128.
212    2345                     BEX1 A1=A1.
                       *         WRITE MESS TO CRT
                       *
                       *         SEND AN ENQ
                        SNDENQ.
213      13                     B=CONPG.                   PG CONPG
214     125                     OUT1=B.
215    1521                     OUT0=0.
216     133                     B=ENQ.                     LOAD ENQ
217     131                     OUT2=B.
220    4104                     DEV1=132.                   SEND CHAR
221    4004                     DEV1=128.
222    1521                     OUT0=0.
                       *         WAIT FOR AN ACK
                        CACKWT.
223      13                     B=ZERO.
224     141                     BEX0 B=B.                  GET BUF ST REG
225     101                     B=B.
226    2627                     IF LST STEP ELSE SKIP.     OUT BUF FULL?
227       3
230    4676                     GOTO RCVACK.               YES, CK IF ACK
231       3
232    4476                     GOTO CACKWT.               NO
                       *         CK IF ACK RECEIVED
                        RCVACK.
233    4004                     DEV1=128.
234      13                     B=CONPG.
235     125                     OUT1=B.
236    4044                     DEV1=130.                  REC CHAR
237    4064                     DEV1=131.
240    4004                     DEV1=128.
241    2345                     BEX1 A1=A1.
242     607                     STEP.
243     211                     A2=1.                      SET WD PTR
244     115                     A3=B.                      A3=CHAR
245     153                     B=ACK.
246    6415                     A3=A3 EQV B.               ACK RECEIVED?
247    3707                     IF ABT SKIP ELSE STEP.
250       3
251    4276                     GOTO SNDENQ.               NO,RESEND ENQ
                       *         SEND CHARS TO CRT
                       *         SEND LFS FROM CONPG
                        WRLFS.
252      13                     B=ZERO.                    GET ST BUF REG
253     141                     BEX0 B=B.
254     101                     B=B.
255     707                     IF MST SKIP ELSE STEP.     IN BUF EMPTY?
256       3
257    5256                     GOTO WRLFS.                NO
260    4004                     DEV1=128.
261      13                     B=CONPG.
262     125                     OUT1=B.
263    4321                     OUT0=A2.                   YES,SEND CHAR
264    4104                     DEV1=132.                  SEND CHAR
265    4004                     DEV1=128.
```

```
266     4211                A2=A2+1.                    INCR WD PTR
267      433                B=17.
270     4415                A3=A2 EQV B.                WD PTR=17
271     3707                IF ABT SKIP ELSE STEP.
272        3
273     5256                GOTO WRLFS.                 NO, SEND NEXT CHAR
274       33                B=CPG.                      YES, SEND PACKET
275      125                OUT1=B.                     PG CPG
276      133                B=5.
277      111                A2=B.                       A2=6.
                    *        SEND PACKET
                  PKSND.
300       13                B=ZERO.                     GET BUF ST REG
301      141                BEXO B=B.
302      101                B=B.
303      707                IF MST SKIP ELSE STEP.      IN BUF EMPTY?
304        3
305     .6016                GOTO PKSND.                 NO
306     4004                DEV1=128.
307       33                B=CPG.
310      125                OUT1=B.
311     4321                OUTO=A2.                    YES,SEND CHAR
312     4104                DEV1=132.                   SEND CHAR
313     4004                DEV1=128.
314     2345                BEX1 A1=A1.                 RD CHAR
315      131                OUT2=B.
316      607                STEP.
317      115                A3=B.
320       73                B=ETX.
321     4211                A2=A2+1.                    INCR WD CTR
322     6415                A3=A3 EQV B.
323     3707                IF ABT SKIP ELSE STEP.      VETX?
324        3
325     6016                GOTO PKSND.                 NO
                    *        CALC BCC
326        4                DEV1=0.
327       53                B=2.
330      115                A3=B.                       WD PTR
331       13                B=CONPG.
332      125                OUT1=B.
333     6321                OUTO=A3.
334     1505                A1=0.
                  CONBCC.
335     2305                A1=A1.
336     2345                BEX1 A1=A1.
337     2505                A1=A1 XOR B.
340     6215                A3=A3+1.                    INCR WD PTR
341      433                B=17.
342     6401                B=A3 EQV B.                 A3=17?
343     3707                IF ABT SKIP ELSE STEP.
344        3
345     6736                GOTO CONBCC.                NO
346       33                B=CPG.                           YES,PG CPG
347      125                OUT1=B.
350      133                B=5.
351      121                OUTO=B.
                  BCC.
352     2305                A1=A1.
353     2345                BEX1 A1=A1.
354     2505                A1=A1 XOR B.
```

```
355      115                    A3=B.
356       73                    B=ETX.
357     6415                    A3=A3 EQV B.
360     3707                    IF ABT SKIP ELSE STEP.      =ETX?
361        3
362     7256                    GOTO BCC.                   NO
363     2331                    OUT2=A1.                    YES,WRT BCC
                        *       SEND BCC.
                     SNDBCC.
364       13                    B=ZERO.
365      141                    BEXO B=B.
366      101                    B=B.
367      707                    IF MST SKIP ELSE STEP.      IN BUF EMPTY?
370        3
371     7516                       GOTO SNDBCC.             NO
372     4004                    DEV1=128.
373       33                    B=CPG.
374      125                     OUT1=B.
375     4321                    OUTO=A2.                    YES,SEND BCC
376     4104                    DEV1=132.                       SEND CHAR
377     4004                    DEV1=128.
                        *             LOOK FOR AN ACK
                     CENDAK.
400       13                    B=ZERO.
401      141                    BEXO B=B.
402      101                    B=B.                    GET BUF ST REG
403     2627                    IF LST STEP ELSE SKIP. OUT BUF FULL?
404       23
405      216                    GOTO ARCVAK.            YES,CK IF ACK
406       23
407       16                    GOTO CENDAK.            NO
                     ARCVAK.
410     4004                    DEV1=128.
411       33                    B=CPG.
412      125                    OUT1=B.
413     1521                    OUTO=0.
414     4044                    DEV1=130.                       REC CHAR
415     4064                    DEV1=131.
416     4004                    DEV1=128.
417     2345                    BEX1 A1=A1.
420      607                    STEP.
421      115                    A3=B.
422      153                    B=ACK.
423     6415                    A3=A3 EQV B.
424     3707                    IF ABT SKIP ELSE STEP.   =ACK?
425      607                    STEP.
426      607                    STEP.
427     7613                    B=TMPAR.
430      105                    A1=B.
431     1511                    A2=0.
                     ELP3.
432     4211                    A2=A2+1.
433     3707                    IF ABT SKIP ELSE STEP.
434       23
435      656                    GOTO ELP3.
436     1511                    A2=0.
437     2205                     A1=A1+1.
440     3707                    IF ABT SKIP ELSE STEP.
441       23
442      656                    GOTO ELP3.
```

```
  443      4004                DEV1=128.
  444        33                B=CPG.
  445       125                OUT1=B.
  446      1521                OUT0=0.                          SND EOT
  447      4113                B=EOT.
  450       131                OUT2=B.
  451      1521                OUT0=0.
  452      4104                DEV1=132.                        SEND CHAR
  453      4004                DEV1=128.
  454         3
  455        16                GOTO SRTT.
                               END?.
THE NUMBER OF ERRORS= 0
TT0 . --  STOP
>
```

PDPO

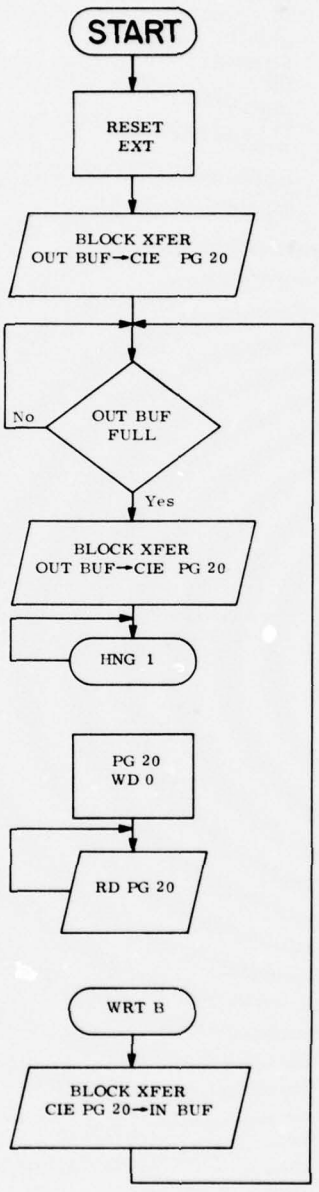


Figure 2-14. PDPO

```
 RUN [20,20]MDMPL
PLEASE ENTER INPUT SOURCE FILE NAME
PDP.DAT
PLEASE ENTER OUTPUT OBJECT FILE NAME
PDP.OBJ
WAIT FOR FIRST PASS - SCAN FOR LABELS
MPAD     CODE

                        $12BIT
                         PROGRAM-ID PDP.
                         PGT VALUE 20.                    PG 4
                         ZERO VALUE 0.
                        *                PDP 11 DIAG PROG
                        *                CKS M1710,PDP CONNECT CIE
                        *                RUN PDP.TSK &
                        *                TYPE 3 LINES ON DECSCOPE.
     0       335                 OUT3 AMPCR=AMPCR.
     1       335                 OUT3 AMPCR=AMPCR.
     2         4                 DEV1=0.
                        *                FAKE BLAST FOR INIT
     3      4351                 BEX2 A2=A2.
     4       513                 B=PGT.
     5       125                 OUT1=B.
     6      1521                 OUT0=0.
     7        44                 DEV1=2.
    10      2053                 B=66.
                         LP1.
    11         1                 B=B+1.
    12      3707                 IF ABT SKIP ELSE STEP.
    13         3
    14       236                 GOTO LP1.
    15        24                 DEV1=1.
    16       607                  STEP.
    17      4351                 BEX2 A2=A2.
                        *                WAIT FOR OUT BUF FULL
                         LKACT.
    20        13                 B=ZERO.
    21       141                 BEX0 B=B.
    22       101                 B=B.                        SET COND F/FS
    23      2707                 IF LST SKIP ELSE STEP.
    24         3
    25       416                 GOTO LKACT.
                        *                RD PACK FROM INT
    26         4                 DEV1=0.
    27      4351                 BEX2 A2=A2.
    30       513                 B=PGT.
    31       125                  OUT1=B.
    32      1521                 OUT0=0.
    33        44                 DEV1=2.
    34      2053                 B=66.
                         LP2.
    35         1                 B=B+1.
    36      3707                 IF ABT SKIP ELSE STEP.
    37         3
    40       736                 GOTO LP2.
    41        24                 DEV1=1.
    42       607                 STEP.
    43      4351                 BEX2 A2=A2.
                         HNG1.
    44         3
    45      1116                 GOTO HNG1.
```

```
                        *               SINGLE STEP TO RD PACKET
                        *               MOVE TO WRTB TO SND BACK
   46         4                         DEV1=0.
   47       513                         B=PGT.
   50      1521                         OUT0=0.
                       RDP.
   51      2305                         A1=A1.
   52      2345                         BEX1 A1=A1.
   53       607                         STEP.
   54         3
   55      1236                         GOTO RDP.
                        *                      WRITE PACKET BACK
                       WRTB.
   56         4                         DEV1=0.
   57        30                         DEV2=1.
   60       607                         STEP.
   61       513                         B=PGT.
   62       125                         OUT1=B.
   63      1521                         OUT0=0.
   64       104                         DEV1=4.
   65      2053                          B=66.
                       LP3.
   66         1                          B=B+1.
   67      3707                         IF ABT SKIP ELSE STEP.
   70         3
   71      1556                         GOTO LP3.
   72        24                         DEV1=1.
   73       607                         STEP.
   74        30                         DEV2=1.
   75       607                         STEP.
   76         3
   77       416                         GOTO LKACT.
                                        END?.

THE NUMBER OF ERRORS= 0
TTO  --  STOP
>
```

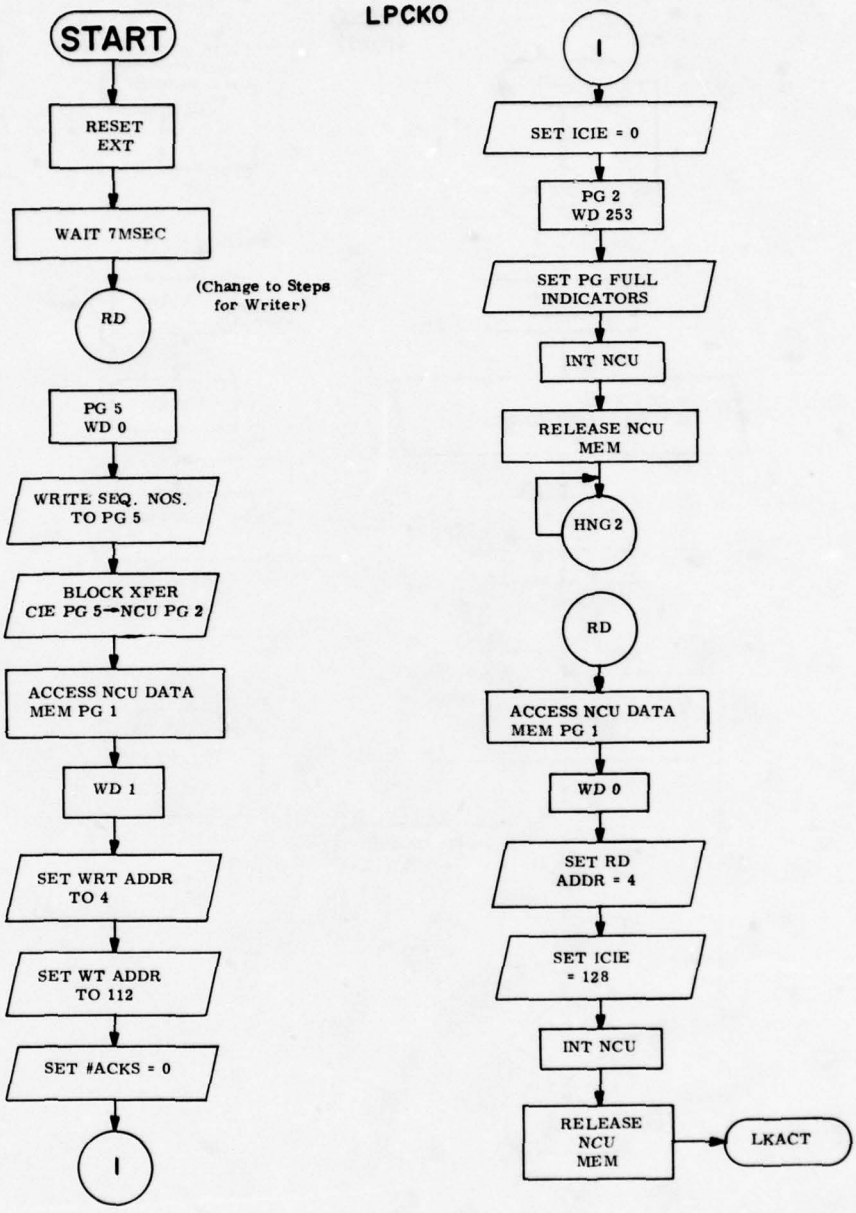


Figure 2-15. LPCKO

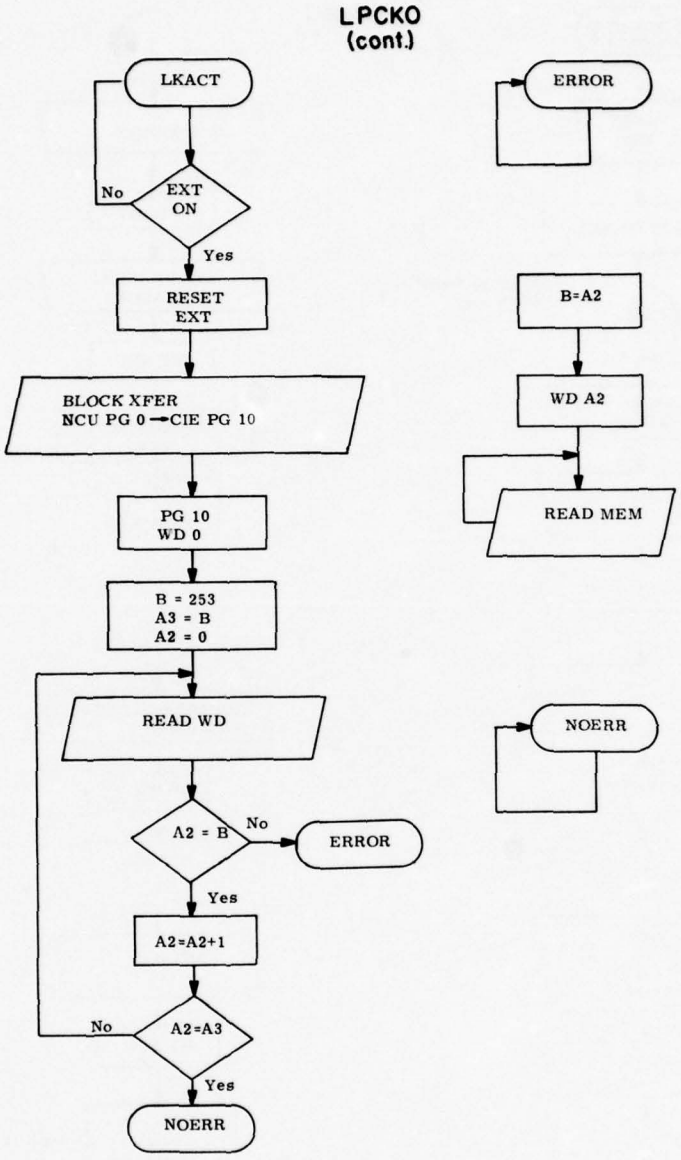


Figure 2-15. (Cont.)

```
 RUN [20,20]MDNPL
PLEASE ENTER INPUT SOURCE FILE NAME
LPCK.DAT
PLEASE ENTER OUTPUT OBJECT FILE NAME
LPCKO.OBJ
WAIT FOR FIRST PASS - SCAN FOR LABELS
MPAD     CODE

                        $12BIT
                         PROGRAM-ID LPCK.
                         ZERO VALUE 0.
                        *              PROG TO CHECK LOOP NODES
                        *               WRITE TO LOOP
    0      335                  OUT3 AMPCR=AMPCR.
    1      335                  OUT3 AMPCR=AMPCR.
    2     7613                  B=248.                    WAIT 7 MSEC
    3      105                  A1=B.
    4     1511                  A2=0.
                         INLP1.
    5     4211                  A2=A2+1.
    6     3707                  IF ABT SKIP ELSE STEP.
    7        3
   10      136                  GOTO INLP1.
   11     1511                  A2=0.
   12     2205                  A1=A1+1.
   13     3707                  IF ABT SKIP ELSE STEP.
   14        3
   15      136                  GOTO INLP1.
   16        3
   17     2216                  GOTO RD.                        MAKE STEPS FOR WRITE
   20        4                  DEV1=0.
   21      133                  B=5.                      PG 5
   22      125                  OUT1=B.
   23     1521                  OUT0=0.
   24       13                  B=ZERO.
   25      131                  OUT2=B.
                         SEVN.
   26        1                  B=B+1.
   27      131                  OUT2=B.
   30     3707                   IF ABT SKIP ELSE STEP.
   31        3
   32      556                  GOTO SEVN.
                        *                BLAST TO NCU PG 2
   33     1521                  OUT0=0.
   34      607                  STEP.
   35     3004                  DEV1=96.
   36       53                  B=2.
   37      125                  OUT1=B.
   40     1521                  OUT0=0.
   41     3204                  DEV1=104.
   42     2053                  B=66.
   43      111                  A2=B.
                         HLDAG.
   44     4211                  A2=A2+1.
   45     3707                  IF ABT SKIP ELSE STEP.
   46        3
   47     1116                  GOTO HLDAG.
   50        4                  DEV1=0.
   51     1521                  OUT0=0.
   52      607                  STEP.
```

```
                    *              FORCE NCU INTO WRITE STATE
 53     3004                 DEV1=96.
 54      201                 B=1.
 55      125                 OUT1=B.
 56      221                 OUT0=1.
 57      113                 B=4.                    WRITE ADDR
 60      131                  OUT2=B.
 61     3413                 B=112.                  WT ADDR
 62      131                 OUT2=B.
 63      133                 B=5.
 64      121                 OUT0=B.
 65     1501                 B=0.
 66      131                 OUT2=B.                         #ACKS=0
 67      113                 B=4.
 70      121                 OUT0=B.
 71     1501                 B=0.
 72      131                 OUT2=B.                         SET ICIE
 73       53                 B=2.                    SET PG FULL
 74      125                 OUT1=B.
 75     7733                 B=253.
 76      121                 OUT0=B.
 77     7773                 B=255.
100      131                 OUT2=B.
101      607                 STEP.
102      131                 OUT2=B.
103     1521                 OUT0=0.
104       20                 DEV0=1.                         INT NCU
105        4                 DEV1=0.                 RELEASE NCU MEM
                    HNG2.
106        3
107     2156                 GOTO HNG2.
                    *              READ A PACKET
                    *              FORCE NCU INTO READ STATE
                    RD.
110        4                 DEV1=0.
111     1521                 OUT0=0.                         CLEAR MAR(CIE)
112      607                 STEP.
113     3004                 DEV1=96.
114      201                 B=1.
115      125                 OUT1=B.
116     1521                 OUT0=0.
117      113                 B=4.
120      131                 OUT2=B.                         READ ADDR=4
121      121                 OUT0=B.
122     4013                 B=128.                  SET ICIE
123      131                 OUT2=B.
124     1521                 OUT0=0.
125       20                 DEV0=1.                         INT NCU
126        4                 DEV1=0.                 RELEASE NCU MEM
                    LKACT.
127     7707                 IF EXT SKIP ELSE STEP.
130        3
131     2576                 GOTO LKACT.
                    *              BLAST NCU-CIE
132      335                 OUT3 AMPCR=AMPCR.
133      335                  OUT3 AMPCR=AMPCR.
134        4                 DEV1=0.
135      253                 B=10.                   PG 10
136      125                 OUT1=B.
137     1521                 OUT0=0.
```

```
140      607                    STEP.
141     3004                    DEV1=96.
142       13                      B=ZERO.
143      125                    OUT1=B.
144     1521                    OUT0=0.
145     2404                    DEV1=80.
146     2053                    B=66.
147      111                    A2=B.
                       AGAIN.
150     4211                     A2=A2+1.
151     3707                    IF ABT SKIP ELSE STEP.
152        3
153     3216                    GOTO AGAIN.
154       24                    DEV1=1.
155     1521                   OUT0=0.
156      607                   STEP.
157        4                    DEV1=0.
160      253                   B=10.
161      125                    OUT1=B.                 PG 10
162       13                    B=ZERO.
163      121                    OUT0=B.
164     7733                    B=253.
165      115                    A3=B.
166     1511                    A2=0.
                       *              READ RESULT
                       RDPAC.
167     2305                    A1=A1.
170     2345                    BEX1 A1=A1.
171      607                    STEP.
172     4405                    A1=A2 EQV B.
173     3707                    IF ABT SKIP ELSE STEP.
174        3
175     4156                    GOTO ERROR.
176     4211                    A2=A2+1.
177     6301                    B=A3.
200     4405                    A1=A2 EQV B.            253RD WD?
201     3627                    IF ABT STEP ELSE SKIP.
202        3
203     4436                    GOTO NOERR.             YES
204        3
205     3576                    GOTO RDPAC.
                       ERROR.
206        3
207     4156                    GOTO ERROR.
210     4301                    B=A2.                   WD LOC
211      607                    STEP.
212     4301                   B=A2.
213      121                    OUT0=B.
                       RDERR.
214     2305                    A1=A1.
215     2345                    BEX1 A1=A1.
216      607                    STEP.
217        3
220     4316                    GOTO RDERR.
                       NOERR.
221        3
222     4436                    GOTO NOERR.
                               END?.

THE NUMBER OF ERRORS= 0
TTO  --  STOP
```

GTBOA

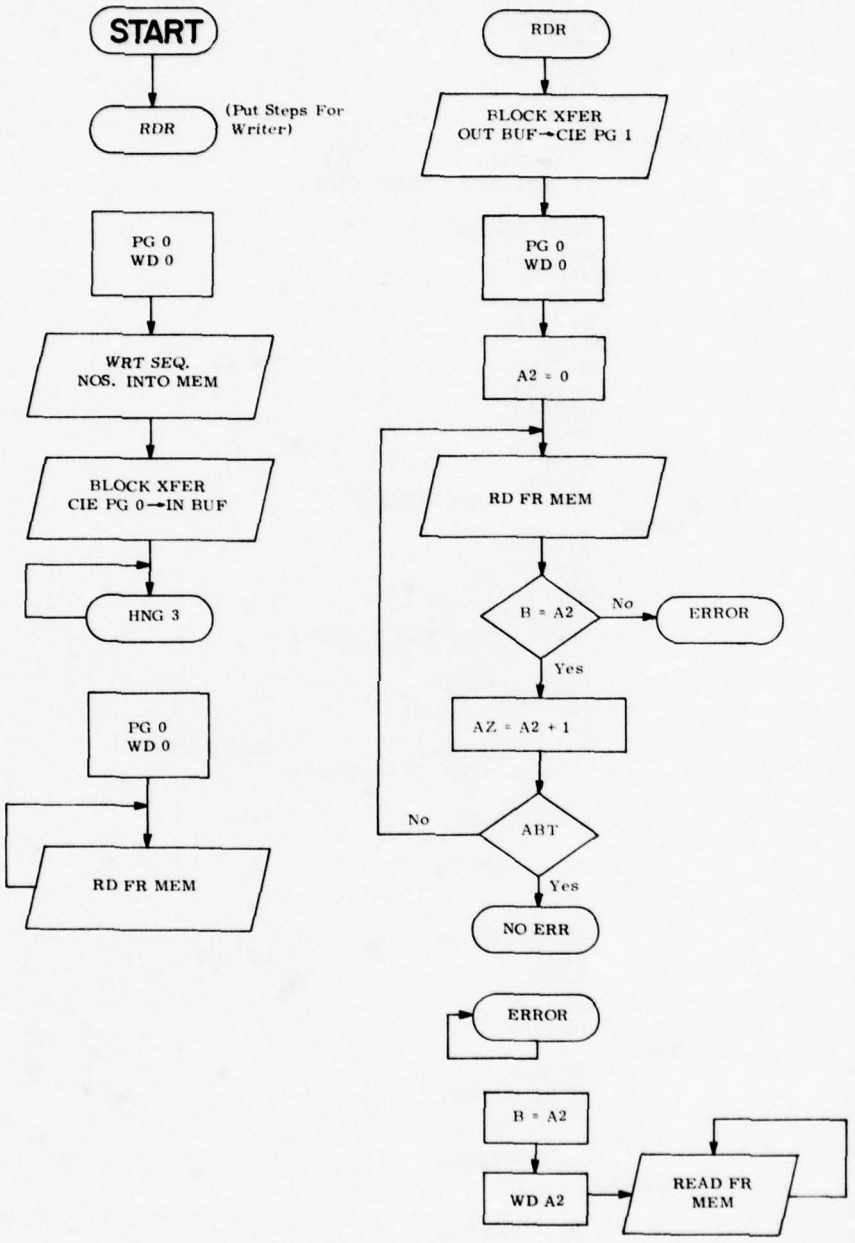


Figure 2-16. GTBOA

```
MCR>SET /UIC=[1,4]
>RUN [20,20]MDMPL
PLEASE ENTER INPUT SOURCE FILE NAME
TI.DAT
PLEASE ENTER OUTPUT OBJECT FILE NAME
TI.OBJ
WAIT FOR FIRST PASS - SCAN FOR LABELS
MPRO      CODE
```

```
                        $12BIT
                         PROGRAM-ID TI.
                        *                TI TERM DIAG
                         LF VALUE 10.
                         CR VALUE 141.
                         ZERO VALUE 0.
                         SRTT.
    0       335                  OUT3 AMPCR=AMPCR.
    1       335                  OUT3 AMPCR=AMPCR.
    2      .104                  DEV1=4.
    3         4                  DEV1=0.
    4        13                  B=ZERO.
    5       125                  OUT1=B.
    6      1521                  OUT0=0.
    7       253                  B=LF.
   10       131                  OUT2=B.
   11       607                  STEP.
                         RPAC.
   12      4004                  DEV1=128.
   13      1525                  OUT1=0.
   14       211                  A2=1.
                         LKCHAR.
   15        13                  B=ZERO.
   16       141                  BEX0 B=B.
   17       101                  B=B.
   20      2707                  IF LST SKIP ELSE STEP.
   21         3
   22       336                  GOTO LKCHAR.
   23      1525                  OUT1=0.
   24      4321                  OUT0=A2.
   25      4044                  DEV1=130.
   26      4064                  DEV1=131.
   27      4004                  DEV1=128.
   30      2345                  BEX1 A1=A1.
   31       607                  STEP.
   32       115                  A3=B.
   33      4333                  B=CR.
   34      4211                  A2=A2+1.
   35      6415                   A3=A3 EQV B.
   36      3707                  IF ABT SKIP ELSE STEP.
   37         3
   40       336                  GOTO LKCHAR.
   41      7613                  B=248.
   42       105                  A1=B.
   43      1511                  A2=0.
                         INLP2.
   44      4211                  A2=A2+1.
   45      3707                  IF ABT SKIP ELSE STEP.
   46         3
   47      1116                   GOTO INLP2.
   50      1511                  A2=0.
```

```
  51      2205                    A1=A1+1.
  52      3707                    IF ABT SKIP ELSE STEP.
  53         3
  54      1116                    GOTO INLP2.
  55        13                    B=ZERO.
  56       125                    OUT1=B.
  57      1511                    A2=0.
                        PKSND.
  60        13                     B=ZERO.
  61       141                    BEX0 B=B.
  62       101                    B=B.
  63       707                    IF MST SKIP ELSE STEP.
  64         3
  65      1416                     GOTO PKSND.
  66      4004                    DEV1=128.
  67        13                    B=ZERO.
  70       125                    OUT1=B.
  71      4321                    OUT0=A2.
  72      4104                    DEV1=132.
  73      4004                    DEV1=128.
  74      2345                     BEX1 A1=A1.
  75       131                    OUT2=B.
  76       607                    STEP.
  77       115                    A3=B.
 100      4333                    B=CR.
 101      4211                     A2=A2+1.
 102      6415                    A3=A3 EQV B.
 103      3707                    IF ABT SKIP ELSE STEP.
 104         3
 105      1416                    GOTO PKSND.
 106      4321                    OUT0=A2.
 107       253                    B=LF.
 110       131                    OUT2=B.
 111       607                    STEP.
                        SNDLF.
 112        13                    B=ZERO.
 113       141                    BEX0 B=B.
 114       101                    B=B.
 115       707                    IF MST SKIP ELSE STEP.
 116         3
 117      2256                    GOTO SNDLF.
 120      4004                    DEV1=128.
 121      1525                    OUT1=0.
 122      4321                     OUT0=A2.
 123      4104                    DEV1=132.
 124      4004                    DEV1=128.
 125         3
 126        16                    GOTO SRTT.
                                  END?.
THE NUMBER OF ERRORS= 0
TT1  --  STOP
>
```

APPENDIX A

B7* PROGRAMMING MANUAL

Appendix A. B7* Programming Manual

This appendix describes the operation of the B7* microprocessor and serves as a programming manual.

2. PRODUCT DESCRIPTION

THE 87* CONSISTS OF TWO L-PROFILE PRINTED CIRCUIT CARDS CONTAINING 65 TTL CHIPS, INCLUDING AN OPTIONAL 256 WORDS OF MICRO PROGRAM MEMORY. DATA PROCESSING IS PERFORMED IN 8-BIT BYTES, I.E., EACH INSTRUCTION OPERATES ON 8 BITS OF DATA.

2.1 FUNCTIONAL ORGANIZATION

THE FUNCTIONAL ORGANIZATION OF THE 87* MICRO-COMPUTER IS SHOWN IN FIGURES 1 AND 2. THE FUNCTIONAL ELEMENTS ARE DESCRIBED BELOW:

2.1.1 MICRO PROGRAM MEMORY (MPM)

THE MICRO PROGRAM MEMORY CONSISTS OF AN OPTIONAL 256 WORDS (12 BITS EACH) OF ROM MEMORY WHICH ARE PLUGGED INTO SOCKETS PROVIDED ON THE P.C. CARDS. ADDITIONAL EXTERNAL PROGRAM MEMORY CAN BE ADDED AS REQUIRED UP TO 65K WORDS. MPM PARITY CHECKING, IF REQUIRED, MUST BE PERFORMED EXTERNALLY.

2.1.2 MEMORY CONTROL UNIT (MCU)

THE MEMORY CONTROL UNIT CONTROLS THE ADDRESSING OF PROGRAM MEMORY. CONTAINED IN THIS AREA ARE THE MPCR (MICRO PROGRAM COUNT REGISTER) AND THE AMPCR (ALTERNATE MICRO PROGRAM COUNT REGISTER). MPCR CONTAINS THE ADDRESS OF THE CURRENT MPM LOCATION BEING ADDRESSED. AMPCR USUALLY CONTAINS A JUMP ADDRESS FOR RETURN FROM SUBROUTINES, BUT WHEN NOT REQUIRED FOR THIS PURPOSE, AMPCR CAN BE USED BY THE LOGIC UNIT AS A SCRATCH PAD REGISTER.

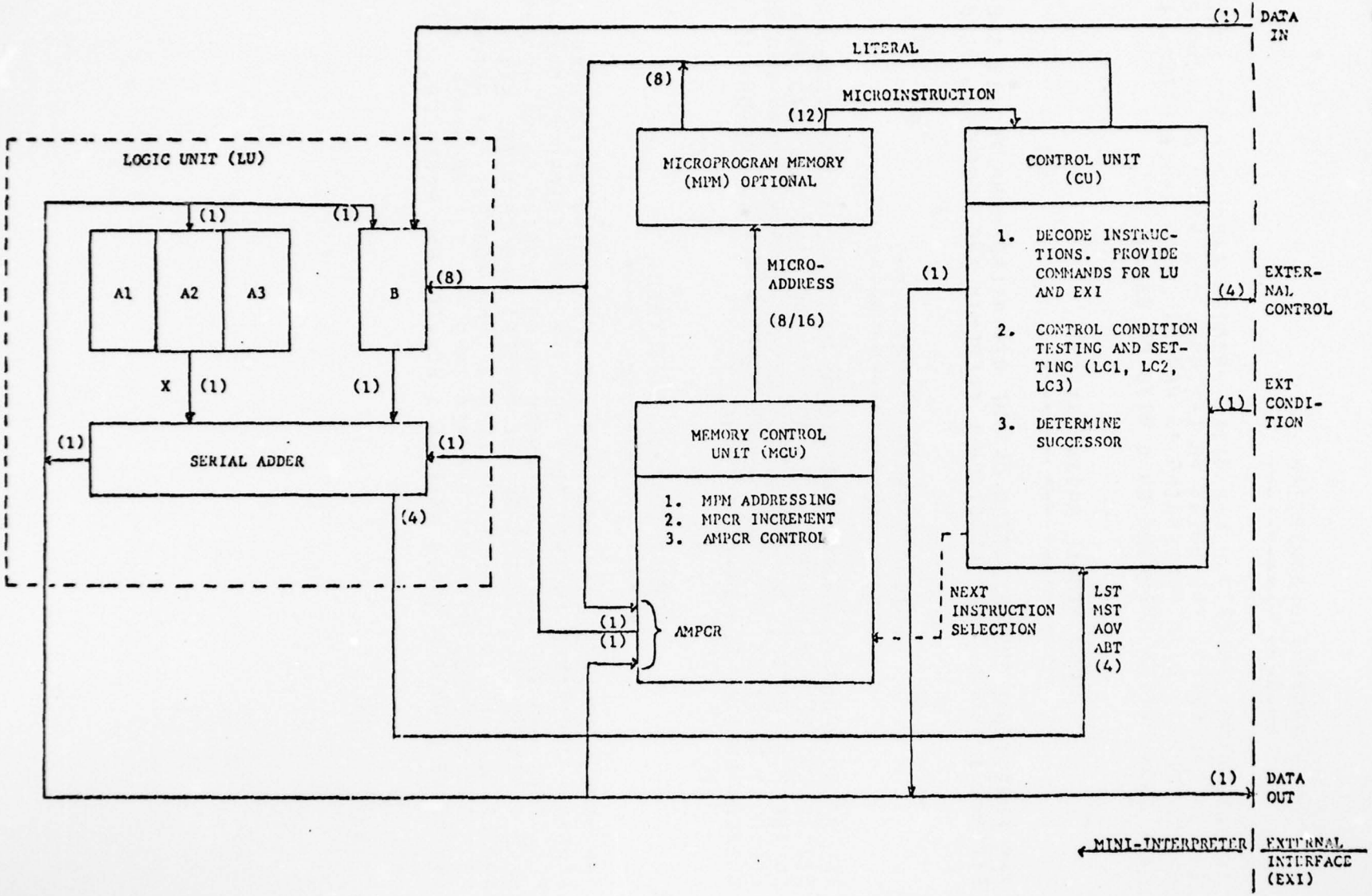


FIGURE 1. B7* GENERAL BLOCK DIAGRAM

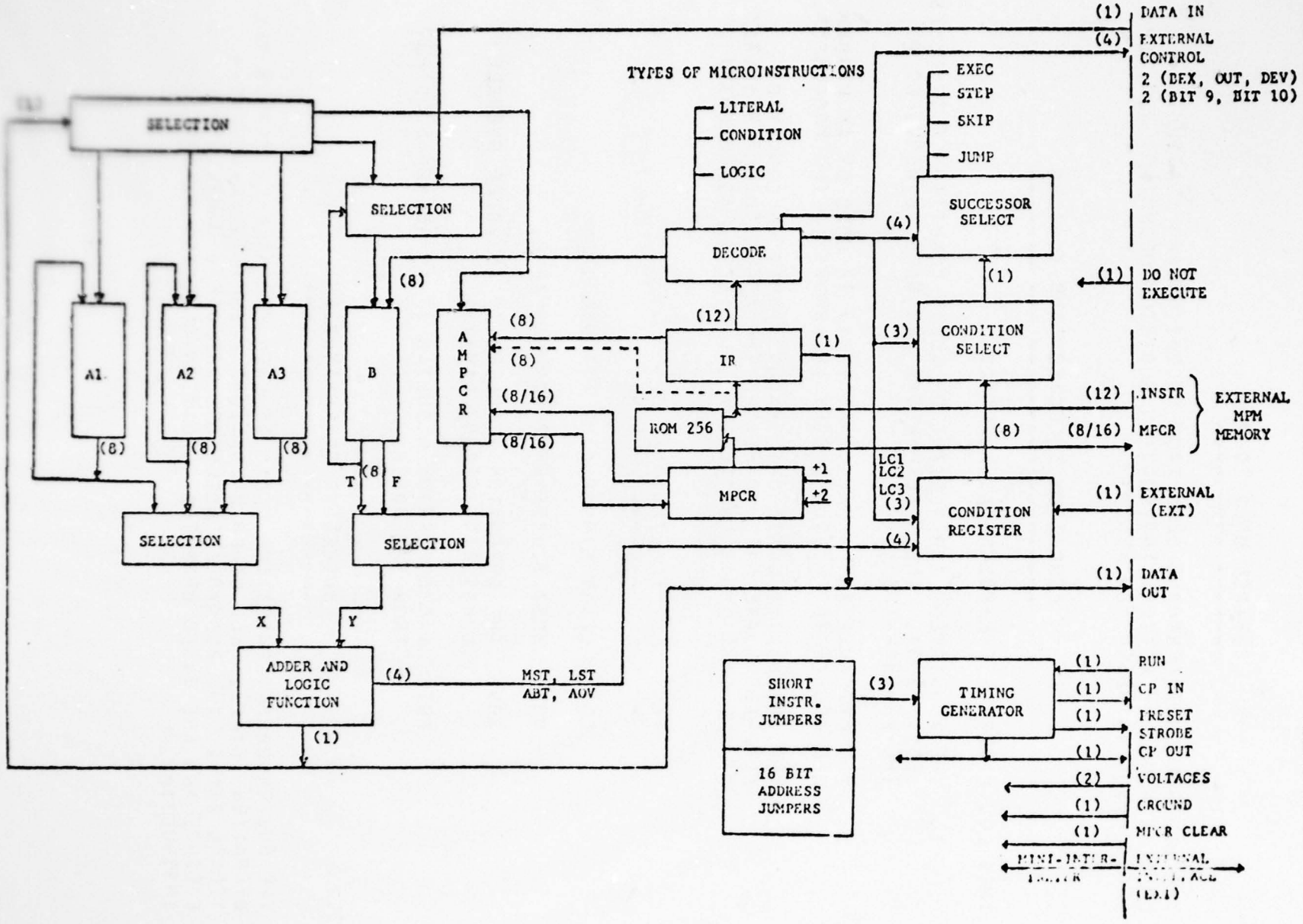


FIGURE 2. GENERAL PURPOSE BLOCK DIAGRAM

2.1.3 CONTROL UNIT (CU)

THE CONTROL UNIT PERFORMS CONDITION SELECTION AND TESTING, SUCCESSOR DETERMINATION, INSTRUCTION REGISTER DECODING, AND TIMING CONTROL AS DESCRIBED BELOW:

2.1.3.1 CONDITION SELECTION AND TESTING

THIS LOGIC SERVES THE FOLLOWING PURPOSES:

1. THE ADJUSTMENT AND TESTING OF LOCAL CONDITION FLIP-FLOPS (LC1, 2, 3). THESE FLIP-FLOPS ARE USED AS REQUIRED BY THE PROGRAMMER.

2. THE EXTERNAL INTERRUPT INPUT (EXT) IS USED BY AN EXTERNAL SOURCE TO PROVIDE A SOFT INTERRUPT TO THE PROCESSOR.

3. THE ARITHMETIC LOGIC UNIT (ALU) OPERATION CONDITION FLIP-FLOPS ARE USED TO RECORD THE ADDER OUTPUT RESULTS OF THE LAST LOGIC UNIT OPERATION (LUOP), AS FOLLOWS:

FF	MEANING WHEN SET
LST	LEAST SIGNIFICANT BIT WAS TRUE.
MST	MOST SIGNIFICANT BIT WAS TRUE.
AOV	THE OPERATION RESULTED IN AN ADDER OVERFLOW (MOST SIGNIFICANT CARRY).
ABT	THE OPERATION RESULTED IN AN ALL-ONES OUTPUT FROM THE ADDER.

2.1.3.2 SUCCESSOR DETERMINATION

THE SUCCESSOR DETERMINATION LOGIC IS USED DURING A CONDITION TEST OPERATION (CTOP). ALL OTHER OPERATIONS RESULT IS AN UNCONDITIONAL STEP. THE POSSIBLE SUCCESSORS ARE STEP, JUMP, SKIP2, OR EXECUTE AND ARE BASED UPON THE CONDITION SELECTED BY THE CTOP INSTRUCTION.

2.1.3.3 INSTRUCTION REGISTER (IR)

THE INSTRUCTION REGISTER IS A 12-BIT REGISTER AND IS LOADED WITH THE INSTRUCTION DATA READ FROM MPM. THE INSTRUCTION REGISTER CONTAINS THE INSTRUCTION CURRENTLY BEING PERFORMED WHILE THE NEXT INSTRUCTION IS BEING READ FROM MPM, THUS PROVIDING AN EXECUTE-FETCH OVERLAP FEATURE.

2.1.3.4 INSTRUCTION DECODING

THE INSTRUCTION DECODING LOGIC DECODES THE CONTENTS OF THE INSTRUCTION REGISTER IN PREPARATION FOR INSTRUCTION EXECUTION. INSTRUCTION DECODING IS ACCOMPLISHED IN THE FIRST CLOCK PERIOD FOLLOWING THE INSTRUCTION REGISTER LOAD.

2.1.4 TIMING CONTROL

FIGURES 3, 4, AND 5 ILLUSTRATE TYPICAL TIMING SEQUENCES FOR VARIOUS B7* INSTRUCTIONS. BASICALLY THERE ARE TWO TYPES OF INSTRUCTIONS: THOSE WHICH ARE PERFORMED SERIALLY (TYPE I) AND THOSE WHICH ARE PERFORMED IN PARALLEL (TYPE II). TYPE I INSTRUCTIONS INCLUDE LOGIC UNIT OPERATIONS AND LITERAL-TO-DEVICE OPERATIONS; ALL OTHER INSTRUCTIONS ARE TYPE II.

TYPE I INSTRUCTIONS REQUIRE NINE CLOCK PERIODS FOR COMPLETION. TYPE II INSTRUCTIONS REQUIRE THREE CLOCK PERIODS FOR DECODING AND EXECUTION PLUS AS MANY ADDITIONAL CLOCK PERIODS AS ARE REQUIRED TO FETCH THE NEXT INSTRUCTION. IN A TYPE I INSTRUCTION THE FETCH TIME OF THE NEXT INSTRUCTION IS OVERLAPPED BY THE SERIAL EXECUTION TIME OF THE CURRENT INSTRUCTION.

FIGURE 3 ILLUSTRATES THE TIMING OF LOGIC UNIT OR LIT-TO-DEVICE INSTRUCTIONS. AT TIME STROBE 7 AND CLOCK (CPIN) THE PREVIOUS INSTRUCTION IS COMPLETED AND THE NEW INSTRUCTION IS SIMULTANEOUSLY LOADED INTO THE INSTRUCTION REGISTER. THE INTERVAL OF TIME STROBE "P" (PRESET) IS USED TO DECODE THE CONTENTS OF THE INSTRUCTION REGISTER IN PREPARATION FOR EXECUTION WHICH IS PERFORMED DURING TIME STROBES 0 THROUGH 7. UPDATING THE PROGRAM COUNTER (MPCR) IS ACCOMPLISHED AT THE CLOCK OF PRESET STROBE AND IS ALWAYS AN INCREMENT (STEP) FOR LOGIC UNIT OR LIT-TO-DEVICE INSTRUCTIONS.

IN SINGLE INSTRUCTION MODE THE B7* WILL PERFORM ONE INSTRUCTION EACH TIME THE "RUN" LINE IS PULSED. THE INSTRUCTION BEING PERFORMED IS SUSPENDED IN THE LAST CLOCK PERIOD OF ITS EXECUTION. UPON RECEPTION OF THE NEXT "RUN" PULSE THE INSTRUCTION HELD IN SUSPENSION IS COMPLETED. A NEW INSTRUCTION IS LOADED INTO THE INSTRUCTION REGISTER, AND THAT INSTRUCTION IS PERFORMED UP TO THE

2.1.4 TIMING CONTROL
(CONTINUED)

FINAL CLOCK WHERE IT IS THEN HELD IN SUSPENSION AWAITING THE NEXT "RUN" PULSE.

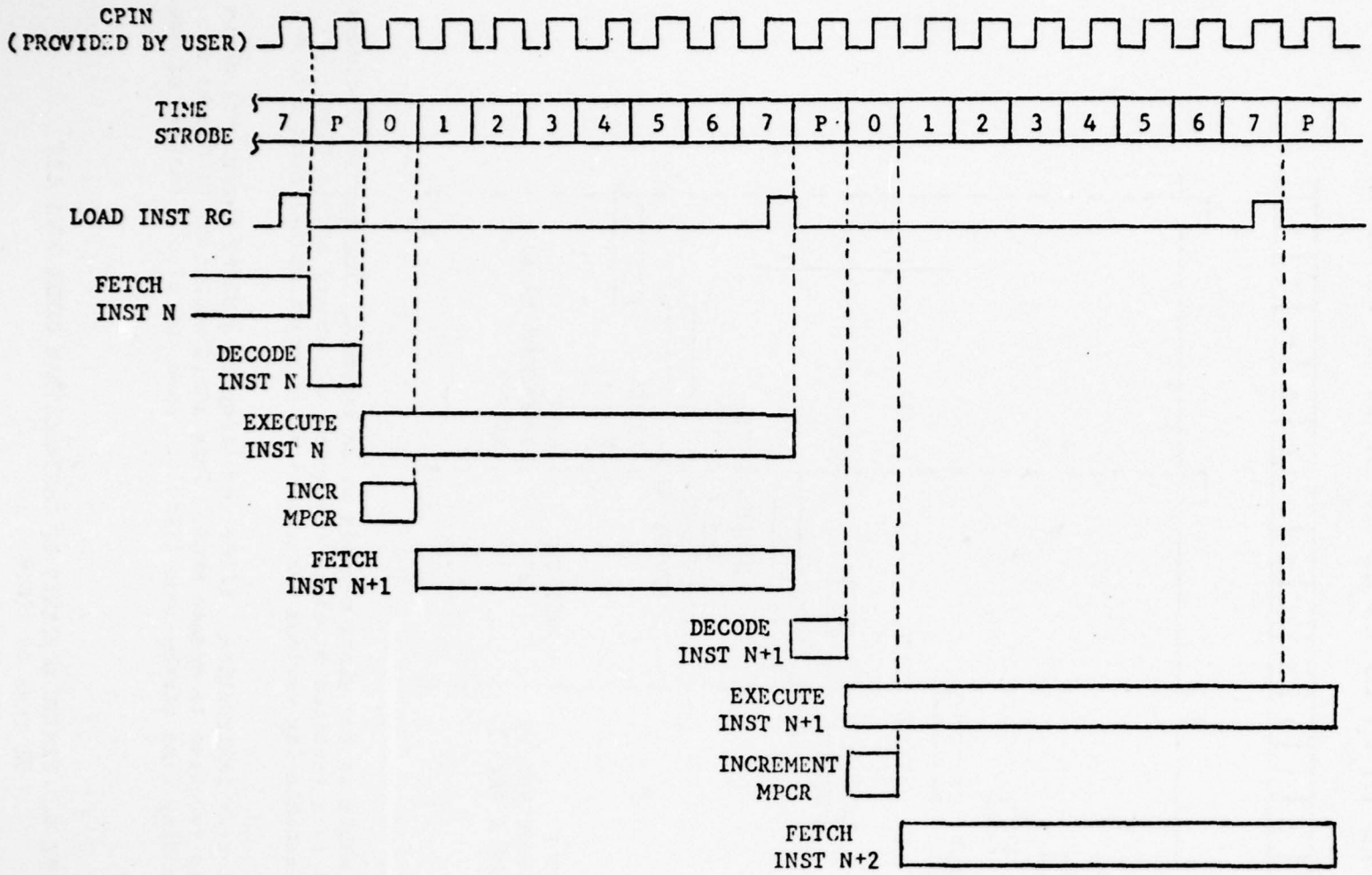
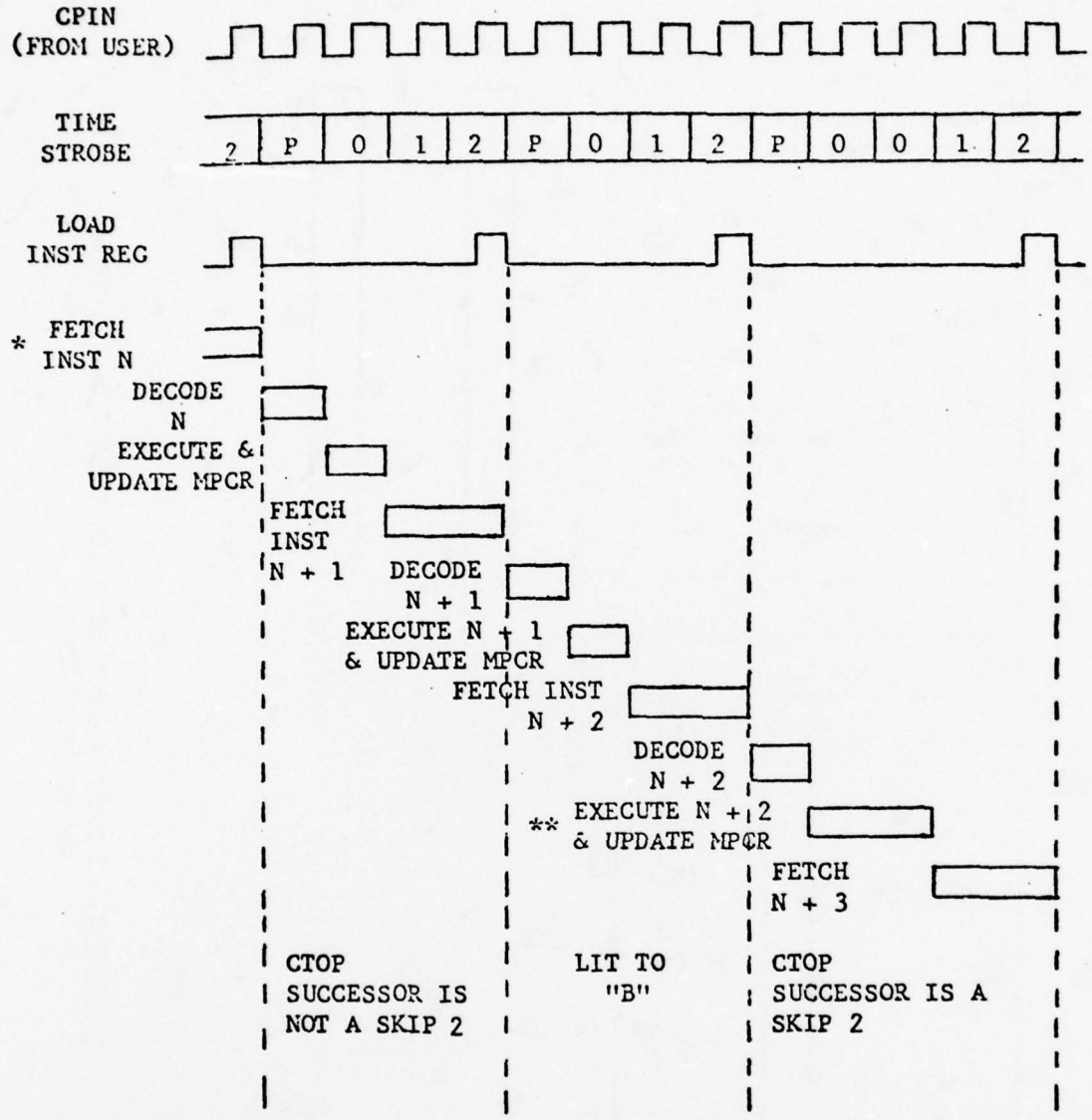


FIGURE 3. TIMING DIAGRAM OF A LOGIC UNIT OR LIT TO DEVICE INSTRUCTION

FEDERAL AND SPECIAL SYSTEMS GROUP



* Fetch Time shown above is two clock periods as an example. The number of clocks actually required is a function of clock frequency and memory access time. The fetch time is presetable (by various insertions of 2 jumper wires) from 1 to 8 clock periods.

** This is a special case instruction. (CTOP resulting in a SKIP2 Successor) where additional time is required to update MPCR. This additional time (1 Clock) is acquired by suspending time strobe zero (TSB0) to span two clocks instead of one.

FIGURE 4. TIMING ANALYSIS OF INSTRUCTIONS OTHER THAN LIT TO DEVS OR LOOPS

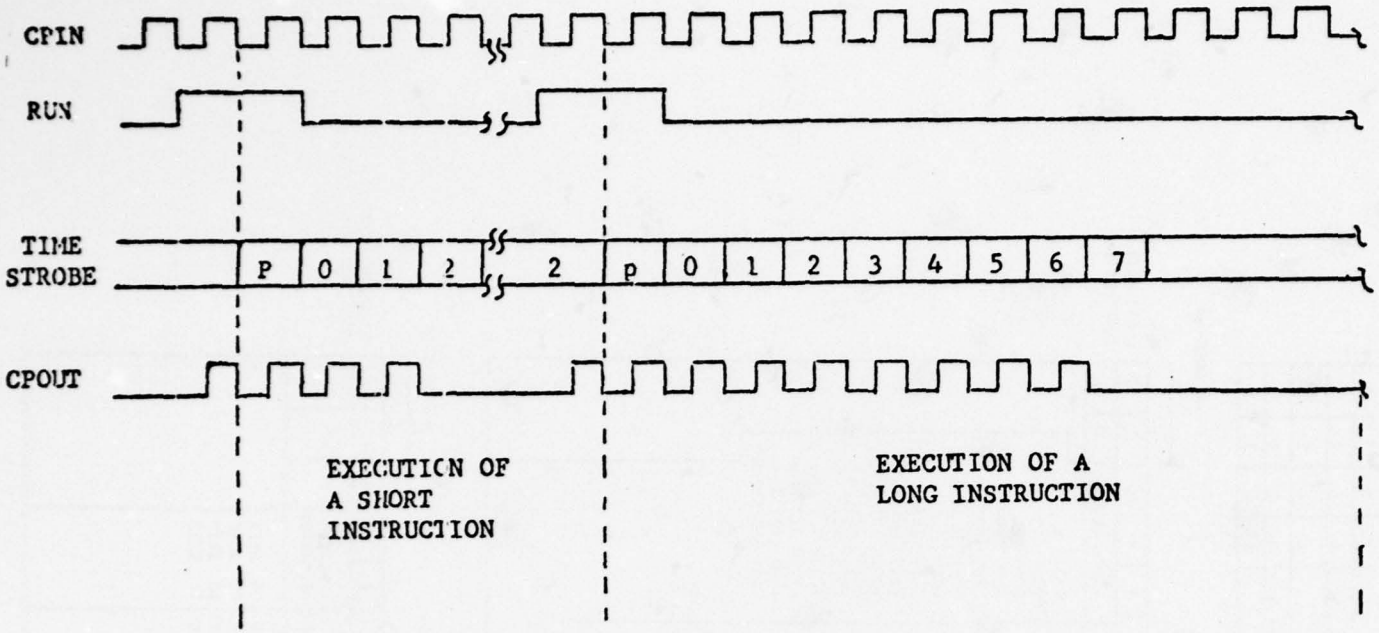


FIGURE 5. TIMING ANALYSIS OF SINGLE INSTRUCTION MODE

OP CODE

1	2	3	4	5	6	7	8	9	10	11	12
LIT. TO DEV (PORT 0)								0	0	0	0
LIT. TO DEV (PORT 1)								0	1	0	0
LIT. TO DEV (PORT 2)								1	0	0	0
LIT. TO DEV (PORT 3)								1	1	0	0
SPARE								0	0	1	0
SPARE								1	0	1	0
CALL (MPCR+1 → AMPCR; LIT & IR → MPCR)								0	1	1	0
GOTO (LIT & IR → MPCR; AMPCR IS UNCHANGED)								1	1	1	0
LIT. TO IR (NO ADD BITS FOR IR LIT GOTO OR CALL)								0	0	1	1
LIT TO B								1	0	1	1

LITERAL INSTRUCTIONS

OP CODE

1	2	3	4	5	6	7	8	9	10	11	12
X SELECT		OPERATION AND Y SELECT					DEST. SELECT			0	1

X SELECT		OPERATION AND Y SELECT		DEST. SELECT	
00	0	0000	X+B+1	0000	B
01	A1	0001	X+B	0001	A1
10	A2	0010*	X+Z+1	0010	A2
11	A3	0011*	X+Z	0011	A3
		0100	X EQV B($XB \vee \overline{X}\overline{B}$)	0100	OUT0 ---
		0101	X XOR B($X\overline{B} \vee \overline{X}B$)	0101	OUT1
		0110	X-B ($X+\overline{B}+1$)	0110	OUT2
		0111	X-B-1 ($X+\overline{B}$)	0111	AMPCR,OUT3
		1000	X NOR B($\overline{X \vee B}$)	1000	B, BEX
		1001	X NAN B($\overline{XB}$)	1001	A1, BEX
		1010*	X NOR Z($\overline{X \vee Z}$)	1010	A2, BEX
		1011*	X NAN Z($\overline{XZ}$)	1011	A3, BEX
		1100	X OR B ($X \vee B$)	1100	B S
		1101	X AND B(XB)	1101	A1 S
		1110	X RIM B ($X \vee \overline{B}$)	1110	A2 S
		1111	X NIM B($\overline{XB}$)	1111	A3,AMPCR

*When Z is not selected as destination, Z = 0.

LOGIC UNIT INSTRUCTION

OP CODE

1	2	3	4	5	6	7	8	9	10	11	12
CONDITION SELECT			SET OPERATION		TRUE SUCCESSOR		FALSE SUCCESSOR		1	1	1

CONDITION SELECT	SET OPERATION	TRUE SUCCESSOR	FALSE SUCCESSOR
000 MST	00 SET LC1	00 STEP	00 STEP
001 AOV	01 SET LC2	01 JUMP	01 JUMP
010 LST	10 SET LC3	10 SKIP	10 SKIP
011 ABT	11 NONE	11 EXEC	11 EXEC
100 LC1			
101 LC2			
110 LC3			
111 EXT			

CONDITION TEST INSTRUCTION

FIGURE 6. B7* INSTRUCTION SET

3. FUNCTIONAL DESCRIPTION

3.1 GENERAL

PROCESSOR OPERATIONS ARE CARRIED OUT BY THE SEQUENTIAL EXECUTION OF MICRO INSTRUCTIONS. EACH MICRO INSTRUCTION IS READ FROM THE PROGRAM MEMORY ON THE INSTRUCTION CYCLE PRECEDING ITS EXECUTION. THE EXECUTION OF EACH INSTRUCTION IS BEGUN BY LOADING THAT INSTRUCTION INTO THE INSTRUCTION REGISTER. IN THE NEXT CLOCK PERIOD (PRESET STROBE) THE NEWLY LOADED INSTRUCTION IS DECODED THE SUCCEEDING CLOCK PERIODS OF THE INSTRUCTION CYCLE WILL THEN BE USED TO EXECUTE THE DECODED INSTRUCTION. UPON COMPLETION OF THE EXECUTION PORTION THE NEXT INSTRUCTION WILL BE LOADED INTO THE INSTRUCTION REGISTER AND THE SEQUENCE DESCRIBED ABOVE IS REPEATED. FIGURE 6 DEFINES THE INSTRUCTION SET OF B7*.

AS SHOWN BY FIGURE 6, THERE ARE THREE CATEGORIES OF INSTRUCTIONS; NAMELY, LITERAL INSTRUCTIONS (PAR. 3.2), LOGIC UNIT INSTRUCTIONS (PAR. 3.3), AND CONDITION TEST INSTRUCTIONS (PAR. 3.4).

3.2 LITERAL INSTRUCTIONS

BITS 9 THROUGH 12 OF THE LITERAL INSTRUCTION ARE USED TO DECODE THE FUNCTIONAL OPERATION OF THE INSTRUCTION. BITS 1 THROUGH 8 REPRESENT A BINARY NUMBER ("LITERAL") TO BE LOADED INTO THE REGISTER AS SPECIFIED BY THE DECODING.

3.2.1 LIT-TO-DEVICE INSTRUCTIONS (DEV0, 1, 2, 3)

THE PURPOSE OF THIS INSTRUCTION IS TO TRANSFER THE LITERAL PORTION OF THE INSTRUCTION TO A PARTICULAR REGISTER IN THE USERS LOGIC. A LITERAL-TO-DEVICE INSTRUCTION IS DECODED WHEN INSTRUCTION BITS 11 AND 12 ARE BOTH ZERO. FURTHER DECODING (THAT OF DEV0, 1, 2, OR 3) IS DEFINED BY INSTRUCTION BITS 9 AND 10. THESE BITS ARE DECODED BY THE USER TO SPECIFY THE PARTICULAR REGISTER TO BE LOADED.

3.2.2 LIT-TO-IR, CALL, AND GOTO INSTRUCTIONS

3.2.2.1 LIT TO IR

THE LIT-TO-IR (LITERAL TO INSTRUCTION REGISTER) INSTRUCTION MUST PRECEDE THE CALL OR GOTO INSTRUCTION IF THE AMPCR AND MPCR ARE GREATER THAN 8 BITS WIDE. THE LIT-TO-IR INSTRUCTION IS USED TO LOAD THE MOST SIGNIFICANT BYTE OF THE GOTO OR CALL ADDRESS INTO THE INSTRUCTION REGISTER FOR TEMPORARY STORAGE WHILE THE CALL OR GOTO INSTRUCTION CONTAINING THE LEAST SIGNIFICANT ADDRESS BYTE IS FETCHED. THE CALL OR GOTO INSTRUCTION WILL LOAD ONLY INTO BITS 9 THROUGH 12 OF THE INSTRUCTION REGISTER THUS LEAVING INSTRUCTION REGISTER BITS 1 THROUGH 8 (MOST SIGNIFICANT ADDRESS BYTE) UNCHANGED AND THERERY PERMITTING THE CONCATENATION OF INSTRUCTION REGISTER BITS 1 THROUGH 8 WITH MEMORY OUTPUT BITS 1 THROUGH 8 TO MAKE UP A 16-BIT CALL OR GOTO ADDRESS.

3.2.2.2 CALL

AS IMPLIED IN THE PREVIOUS PARAGRAPH A CALL INSTRUCTION WITH AN ADDRESS GREATER THAN 8 BITS CAN BE ACCOMPLISHED BY PERFORMING TWO SUCCESSIVE INSTRUCTIONS, NAMELY:

1. LIT-TO-IR (FETCH AND HOLD MOST SIGNIFICANT CALL ADDRESS BYTE).
2. CALL (FETCH LEAST SIGNIFICANT CALL ADDRESS BYTE AND EXECUTE CALL).

THE ADDRESS BYTES OF THESE TWO INSTRUCTIONS ARE CONCATENATED AND PLACED 16 BITS PARALLEL INTO MPCR AND AT THE SAME TIME THE LEAST PREVIOUS CONTENTS OF MPCR ARE INCREMENTED AND PLACED INTO AMPCR AS A RETURN ADDRESS.

IF THE WIDTH OF AMPCR AND MPCR IS NOT GREATER THAN 8 BITS, A CALL OR GOTO NEED NOT BE PRECEDED BY A LIT-TO-IR INSTRUCTION.

3.2.2.3 GOTO

A GOTO INSTRUCTION OF GREATER THAN 8 BITS IS ACCOMPLISHED BY TWO SUCCESSIVE INSTRUCTIONS NAMELY: (1) LIT-TO-IR AND (2) GOTO. THE ADDRESS BYTES OF THE TWO INSTRUCTIONS ARE CONCATENATED AND PLACED 16 BITS PARALLEL INTO THE MPCR. THE CONTENTS OF AMPCR ARE NOT CHANGED.

3.2.2.4 LIT TO B

THE LIT-TO-B (LITERAL TO B-REGISTER) INSTRUCTION IS DECODED WHEN BITS 9 THROUGH 12 EQUAL BINARY 1011 RESPECTIVELY. THIS WILL RESULT IN INSTRUCTION REGISTER BITS 1 TO 8 TO BE PARALLEL TRANSFERRED INTO THE B REGISTER. MPCR IS INCREMENTED AND THE INSTRUCTION IS COMPLETE.

3.3 LOGIC UNIT INSTRUCTIONS (LUOP)

A LUOP INSTRUCTION IS DECODED WHEN INSTRUCTION REGISTER BITS 11 AND 12 ARE A BINARY 0 AND 1 RESPECTIVELY. A LUOP WILL ALWAYS RESULT IN A "STEP" (MPCR INCREMENT); NO OTHER SUCCESSOR IS POSSIBLE. PARS. 3.3.1 AND 3.3.2 GIVE THE FORMATS AND DEFINITIONS OF THE INSTRUCTION REGISTER BITS.

3.3.1 FORMAT OF LOGIC UNIT INSTRUCTION

```
      INSTRUCTION REGISTER BITS
     |-------------------------|
      1 2 3 4 5 6 7 8 9 10 11 12
     ---------------------------
     | X | OP + Y| DEST.  | 0 1 |
     ---------------------------
       |   |          |      |
       |   |          |      |
       |   |          |      ------------------------- COMMAND CODE
       |   |          ---------------------- DESTINATION
       |   ----- OPERATION AND Y SELECT @
X SELECT
00  0          0000  X+B+1                  0000  B
00  A1         0001  X+B                    0001  A1
10  A2        *0010  X+Z+1                  0010  A2
11  A3        *0011  X+Z                    0011  A3
                                  --
               0100  X EQV B (XBVXB)        0100  OUT 0
                                 - -
               0101  X XOR B (XBVXB)        0101  OUT 1
               0110  X-B (X+B+1)            0110  OUT 2
                                 -
               0111  X-B-1 (X+B)            0111  AMPCR, OUT 3
                                 ---
               1000  X NOR B (XVB)         #1000  B, BEX 0
                                 --
               1001  X NAN B (XB)          #1001  A1, BEX 1
                                 ---
              *1010  X NOR Z (XVZ)         #1010  A2, BEX 2
                                 --
              *1011  X NAN Z (XZ)          #1011  A3, BEX 3
               1100  X OR B (XVB)          %1100  B S
               1101  X AND B (XB)          %1101  A1 S
                                 -
               1110  X RIM B (XVB)         %1110  A2 S
                                 =
               1111  X NIM B (XB)           1111  A3, AMCPR
```

* Z = AMPCR. WHEN AMPCR IS NOT SELECTED AS A DESTINATION, THEN AMPCR WILL BE "ZERO" (I.E., Z = 0) IN ALL OPERATIONS AS A Y-SELECT INPUT.

@ Y-SELECT = B OR Z AS INDICATED.

"BEX" INDICATES SERIAL TRANSFER FROM EXTERNAL REGISTER TO B-REGISTER WHILE ADDER TRANSFERS TO OTHER SPECIFIED REGISTER (IF B, THEN 2 INPUTS ARE ORED).

% "S" INDICATES A ONE-BIT RIGHT SHIFT OF THE DESTINATION REGISTER END OFF, WITH THE MSB BEING FILLED BY THE ADDER OUTPUT.

3.3.2 FORMAT DEFINITION

THE LOGIC UNIT INSTRUCTION SPECIFIES THE ADDER INPUTS, THE OPERATION, AND THE DESTINATION SPECIFICATIONS FOR THE ADDER. THE X-SELECT TO THE INPUT OF THE ADDER IS EITHER NONE OR ONE OF THE THREE A-REGISTERS (SPECIFIED BY BITS 1, 2). THE OPERATION AND Y-SELECT TO THE INPUT OF THE ADDER ARE SPECIFIED BY BITS 3, 4, 5, AND 6 AND INCLUDE BOTH ARITHMETIC AND LOGIC OPERATIONS ON BOTH THE AMPCR AND B-REGISTER AS INDICATED. THE DESTINATIONS OF THE ADDER OUTPUT AS SHOWN ARE SPECIFIED BY BITS 7, 8, 9, AND 10. THE OUTPUT OF THE ADDER CAN GO TO B, A1, A2, OR A3. THE ADDER OUTPUT ALWAYS GOES TO THE EXTERNAL INTERFACE WHEN A LOGIC OPERATION IS SELECTED, BUT IF ANY "OUT" IS SELECTED AS A DESTINATION, THEN A SPECIAL 4-BIT CODE IS GENERATED ON THE EXTERNAL CONTROL LINES TO ENABLE GATING FROM THE ADDER TO THE PARTICULAR EXTERNAL REGISTER, OF COURSE, THIS IS TRUE ONLY IF THE EXTERNAL INTERFACE IS DESIGNED TO PERFORM THIS FUNCTION. NOTE THAT IF ANY OF THE "BEX" DESTINATIONS ARE SELECTED, A 4-BIT SELECTION CODE IS SENT OUT ON THE EXTERNAL CONTROL LINES THUS ENABLING AN 8-BIT SERIAL TRANSFER FROM THE SELECTED EXTERNAL REGISTER TO THE B-REGISTER TO TAKE PLACE IN PARALLEL WITH THE ADDER OUTPUT INTO THE SPECIFIED REGISTER (I.E., A1, A2, A3, B). IF THE DESTINATION REGISTER IS "B, BEX", THEN AN "OR" OF THE ADDER OUTPUT AND THE EXTERNAL INPUT IS PERFORMED. NORMALLY, THE ADDER OUTPUT IN THIS CASE WOULD BE SET TO TRANSFER ZEROS FROM THE ADDER, THEREBY ALLOWING A SIMPLE EXTERNAL LOAD OF THE B-REGISTER.

AS NOTED BY "*", IF THE AMPCR IS NOT SELECTED AS THE DESTINATION REGISTER, THEN THE FOUR OPERATIONS USING AMPCR AS A Y-SELECT WILL HAVE "ZERO" FOR A Y-INPUT. THIS MEANS OPERATIONS USING AMPCR AS A Y-SELECT CAN ONLY BE TRANSFERRED BACK TO AMPCR OR A3. THROUGH THE USE OF THIS FEATURE "0", "0-NOT", "X", AND "X-NOT" CAN BE TRANSFERRED TO ANY DESTINATION REGISTER EXCEPT THE AMPCR.

THE DESTINATIONS WITH "S" (FOR SHIFT) ALLOW THE DESTINATIONS TO BE SHIFTED RIGHT END-OFF BY ONE BIT, AND THE MOST SIGNIFICANT BIT IS SUPPLIED BY THE ADDER OPERATING ON THE LEAST SIGNIFICANT BIT OF THE "X" AND "Y" SELECTED OPERANDS. IT SHOULD BE NOTED THAT THE ADDER OPERATION IS PERFORMED ON ALL EIGHT BITS OF THE INPUT OPERANDS; THE ADDER CONDITION BITS (LST, MST, ABT, AOV) ARE SET ACCORDINGLY.

IF ONE WISHES TO PERFORM A RIGHT SHIFT (END-OFF) OF ONE BIT ON THE "B" DESTINATION, THEN SELECT (X=0, X+B, B S) FOR THE INSTRUCTION. THE PRIMARY PURPOSE OF THE SHIFT OF THE DESTINATION IS TO ACHIEVE RIGHT AND CIRCULAR SHIFTS ON A1, A2, AND B, BUT ALL OTHER ALLOWED FUNCTIONS ARE VALID INTO THE DESTINATION'S MOST SIGNIFICANT BIT. IF THE (X=A1, X+B, A1 S) INSTRUCTION IS USED, THE ADDITION TAKES PLACE ON BIT 8 OF BOTH "A" AND "B", AND THE RESULTING BIT IS PLACED INTO BIT 1 (MSB) OF A1; THEREAFTER, BIT 7 (LSB+1) OF A1 IS ADDED TO ALL BITS OF "B", AND THE SIDE EFFECTS

AD-A063 394 BURROUGHS CORP PAOLI PA FEDERAL AND SPECIAL SYSTEMS GROUP F/G 17/2
EXPLORATORY SYSTEMS CONTROL MODEL (ESM). SOFTWARE MAINTENANCE M--ETC(U)
APR 77 DCA100-75-C-0054
UNCLASSIFIED 66143-3-BK-2 SBIE-AD-E100 138 NL

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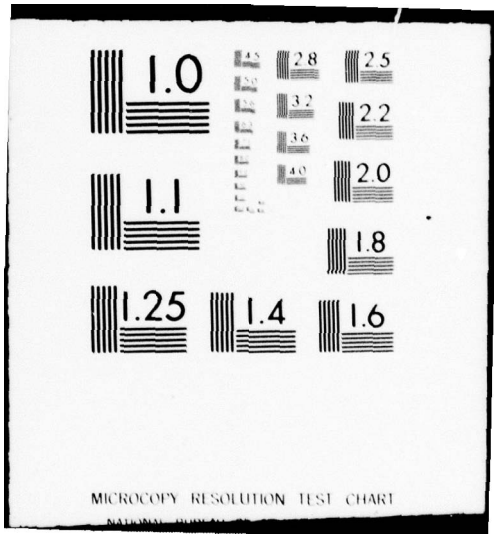
1.0
1.1
1.25
1.4
1.6
1.8
2.0
2.2
2.5
2.8
3.2
3.6
4.0
MICROCOPY RESOLUTION TEST CHART

3.3.2 (CONTINUED) FORMAT DEFINITION

ON THE ADDER CONDITION BITS RESULT ACCORDINGLY. THE LAST NOTEWORTHY SIDE EFFECT OF A SERIAL IMPLEMENTATION OF THE ADDER IS THAT THE ADDER OVERFLOW (AOV) CONDITION IS ACTUALLY THE INITIAL AND INTERMEDIATE CARRY FLIP-FLOP FOR THE SERIAL ADDER. AS SUCH, WHENEVER A "+1" OPERATION IS CALLED FOR, THE INITIAL CARRY IS SET. IN FACT, THE INITIAL CARRY IS SET WHENEVER BIT 6 OF THE OPERATION AND Y-SELECT FIELD IS ZERO. HOWEVER, THE INITIAL CARRY FLIP-FLOP IS ENABLED FOR INTERMEDIATE CARRIES ONLY ON ARITHMETIC FUNCTIONS. FOR EXAMPLE, ON AN "X OR B" OPERATION, BIT 6 IS ZERO, THEREFORE "AOV" IS SET AND REMAINS SET UNTIL A SUBSEQUENT LOGIC UNIT OPERATION CHANGES IT.

3.4 CONDITION TEST (CTOP) INSTRUCTIONS

A CTOP IS DECODED WHEN INSTRUCTION REGISTER BIS 10, 11, AND 12 ARE ALL ONES. THE REMAINING BITS (1 THROUGH 9) ARE DECODED AS FOLLOWS:

CTOP BITS	FUNCTION
1-3	SELECTS THE CONDITION TO BE SELECTED.
4-5	CONTROLS THE SET OPERATION OF THE LOCAL CONDITION FLIP-FLOPS.
6-7	SELECTS THE SUCCESSOR (STEP, JUMP, SKIP2, OR EXEC) IF SELECTED CONDITION IS TRUE.
8-9	SELECTS THE SUCCESSOR (STEP, JUMP, SKIP2, OR EXEC) IF SELECTED CONDITION IS FALSE.

3.4.1 CONDITION SELECT

THE FOLLOWING IS A BRIEF DESCRIPTION OF EACH OF THE SELECTABLE CONDITIONS.

3.4.1.1 MST, AOV, LST, ABT

THESE CONDITIONS REFLECT THE RESULTS (ADDER OUTPUT) OF THE LAST LOOP:

MST - MOST SIGNIFICANT BIT WAS TRUE.

AOV - ADDER OVERFLOW (MOST SIGNIFICANT CARRY).

LST - LEAST SIGNIFICANT BIT WAS TRUE.

ABT - ALL BITS TRUE (ADDER RESULT WAS ALL ONES).

3.4.1.2 LC1, LC2, LC3

THESE ARE LOCAL CONDITION FLAGS THAT ARE SET BY PROGRAM CONTROL (PAR. 3.4.2) AND ARE RESET WHEN TESTED.

3.4.2 LOCAL CONDITIONS SET CONTROL

AS DESCRIBED IN PAR. 3.4, THE SET FUNCTION FOR LOCAL CONDITION FLIP-FLOPS IS CONTROLLED BY INSTRUCTION BITS 4 AND 5 OF A CTOP. THE SET FUNCTION SPECIFIED BY BITS 4 AND 5 WILL ONLY OCCUR IF THE TEST CONDITION SELECTED BY BITS 1, 2, AND 3 IS TRUE.

EXAMPLE 1: IF LC1 THEN SET LC1 SKIP ELSE JUMP.
THIS INSTRUCTION WILL NOT CHANGE THE STATE OF LC1. IF IT IS SET IT WILL REMAIN SET. IF LC1 IS NOT SET, IT WILL REMAIN RESET.

EXAMPLE 2: IF LC1 THEN STEP ELSE SKIP.
THIS INSTRUCTION WILL ALWAYS RESET LC1 AFTER TESTING IT.

EXAMPLE 3: IF MST THEN SET LC1 STEP ELSE STEP.
THIS INSTRUCTION WILL SET LC1 IF MST = 1; OTHERWISE LC1 WILL BE LEFT UNCHANGED.

3.4.3 SUCCESSOR SELECT

SUCCESSOR SELECTION IS SPECIFIED BY INSTRUCTION BITS 6, 7, 8, AND 9 OF A CROP. BITS 6 AND 7 SPECIFY THE SUCCESSOR IF THE CONDITION SELECTED BY BITS 1, 2, AND 3 IS TRUE; HOWEVER, IF THE SELECTED CONDITION IS FALSE, THEN BITS 8 AND 9 WILL SPECIFY THE SUCCESSOR. AN UNCONDITIONAL SUCCESSOR IS SPECIFIED BY SELECTING THE SAME SUCCESSOR FOR THE TRUE AND FALSE CONDITION. THE POSSIBLE SUCCESSOR SELECTIONS ARE:

3.4.3.1 STEP

MPCR IS INCREMENTED THUS THE NEXT INSTRUCTION WILL BE FETCHED FROM THE MICRO PROGRAM MEMORY AT THE NEXT SEQUENTIAL ADDRESS.

3.4.3.2 JUMP

A COPY OF THE CONTENTS OF AMPCR IS LOADED INTO MPCR, THE PREVIOUS CONTENTS OF MPCR IS DISCARDED. THUS THE NEXT INSTRUCTION FETCHED FROM THE MICRO PROGRAM MEMORY WILL BE AT THE ADDRESS SPECIFIED BY MPCR, WHICH NOW IS THE SAME AS AMPCR.

3.4.3.3 SKIP

FOR B7* MACHINES WHERE MPCR AND AMPCR ARE ONLY 8 BITS WIDE, MPCR IS INCREMENTED TWICE, THUS THE NEXT INSTRUCTION IS FETCHED FROM THE MICRO PROGRAM MEMORY AT THE CURRENT ADDRESS + 2.

FOR B7* MACHINES WHERE MPCR AND AMPCR ARE GREATER THAN 8 BITS WIDE, "SKIP" WILL BE MODIFIED BY ADDING A JUMPER WIRE. THIS MODIFICATION WILL CAUSE MPCR TO BE INCREMENTED THREE TIMES AND THEREFORE THE NEXT INSTRUCTION FETCHED FROM MICRO PROGRAM MEMORY WILL BE FROM THE CURRENT ADDRESS + 3. THIS FEATURE ALLOWS SKIPPING OVER THE NEXT TWO INSTRUCTIONS. A TWO-INSTRUCTION "SKIP" IS REQUIRED BECAUSE "GOTO" AND "CALL" FUNCTIONS REQUIRE TWO SUCCESSIVE INSTRUCTIONS WHEN AMPCR AND MPCR ARE GREATER THAN 8 BITS WIDE.

3.4.3.4 EXECUTE

THE "EXECUTE" SUCCESSOR IS USED TO PERFORM ONE INSTRUCTION (SPECIFIED BY AMPCR) OUT OF SEQUENCE. "EXECUTE" REQUIRES TWO INSTRUCTION PERIODS FOR COMPLETION. THE FIRST INSTRUCTION PERIOD WILL INCREMENT MPCR, SWAP THE CONTENTS OF AMPCR AND MPCR, AND THEN FETCH THE INSTRUCTION PER MPCR (ORIGINALLY AMPCR). THE SECOND INSTRUCTION PERIOD WILL EXECUTE THE INSTRUCTION FETCHED ABOVE, INCREMENT MPCR, AGAIN SWAP THE CONTENTS OF AMPCR AND MPCR, AND FETCH THE INSTRUCTION SPECIFIED BY MPCR.

IN SUMMARY, AN "EXECUTE" WILL PERFORM THE INSTRUCTION SPECIFIED BY AMPCR AND INCREMENT BOTH AMPCR AND MPCR.

APPENDIX B

MDMPL INSTRUCTION LIST

Appendix B. MDMPL Instruction List

This appendix provides a list of MDMPL instructions.

MINI-D INSTRUCTION LIST 2-23-73.

CALL AND GOTO INSTRUCTIONS WILL REQUIRE 2 BYTE CODE.

DEV0 = LITERAL-DEFINE.	XXXXXXXX0000
DEV1 = LITERAL-DEFINE.	XXXXXXXX0100
DEV2 = LITERAL-DEFINE.	XXXXXXXX1000
DEV3 = LITERAL-DEFINE.	XXXXXXXX1100
B = B + 1.	0000000000001
B = A1 + B + 1.	0100000000001
B = A2 + B + 1.	1000000000001
B = A3 + B + 1.	1100000000001
B = B.	0000100000001
B = A1 + B.	0100100000001
B = A2 + B.	1000100000001
B = A3 + B.	1100100000001
B = 1.	0000100000001
B = A1 + 1.	0100100000001
B = A2 + 1.	1000100000001
B = A3 + 1.	1100100000001
B = 0.	0000110000001
B = A1.	0100110000001
B = A2.	1000110000001
B = A3.	1100110000001
B = 0 EQV B.	0001000000001
B = A1 EQV B.	0101000000001
B = A2 EQV B.	1001000000001
B = A3 EQV B.	1101000000001
B = A1 XOR B.	0101010000001
B = A2 XOR B.	1001010000001
B = A3 XOR B.	1101010000001
B = BF + 1.	0001100000001
B = A1 - B.	0101100000001
B = A2 - B.	1001100000001
B = A3 - B.	1101100000001
B = BF.	0001110000001
B = A1 - B - 1.	0101110000001
B = A2 - B - 1.	1001110000001
B = A3 - B - 1.	1101110000001
B = A1 NOR B.	0110000000001
B = A2 NOR B.	1010000000001
B = A3 NOR B.	1110000000001
B = A1 NAN B.	0110010000001
B = A2 NAN B.	1010010000001
B = A3 NAN B.	1110010000001
B = ONES.	0010100000001
B = A1F.	0110100000001
B = A2F.	1010100000001
B = A3F.	1110100000001
B = A1 OR B.	0111000000001
B = A2 OR B.	1011000000001
B = A3 OR B.	1111000000001
B = A1 AND B.	0111010000001
B = A2 AND B.	1011010000001
B = A3 AND B.	1111010000001
B = A1 OR BF.	0111100000001
B = A2 OR BF. — OR BF = RIM B	1011100000001
B = A3 OR BF.	1111100000001
B = A1 AND BF.	0111110000001
B = A2 AND BF. — AND BF = NIM B	1011110000001

```
B = A3 AND BF.   AND. BF = NIM B                  111111000001
      A1 = B + 1.                                 000000000101
A1 = A1 + B + 1.                                  010000000101
A1 = A2 + B + 1.                                  100000000101
A1 = A3 + B + 1.                                  110000000101
      A1 = B.                                     000001000101
A1 = A1 + B.                                      010001000101
A1 = A2 + B.                                      100001000101
A1 = A3 + B.                                      110001000101
      A1 = 1.                                     000010000101
A1 = A1 + 1.                                      010010000101
A1 = A2 + 1.                                      100010000101
A1 = A3 + 1.                                      110010000101
      A1 = 0.                                     000011000101
      A1 = A1.                                    010011000101
      A1 = A2.                                    100011000101
      A1 = A3.                                    110011000101
      A1 = 0 EQV B.                               000100000101
A1 = A1 EQV B.                                    010100000101
A1 = A2 EQV B.                                    100100000101
A1 = A3 EQV B.                                    110100000101
A1 = A1 XOR B.                                    010101000101
A1 = A2 XOR B.                                    100101000101
A1 = A3 XOR B.                                    110101000101
      A1 = BF + 1.                                000110000101
A1 = A1 - B.                                      010110000101
A1 = A2 - B.                                      100110000101
A1 = A3 - B.                                      110110000101
      A1 = BF.                                    000111000101
A1 = A1 - B - 1.                                  010111000101
A1 = A2 - B - 1.                                  100111000101
A1 = A3 - B - 1.                                  110111000101
A1 = A1 NOR B.                                    011000000101
A1 = A2 NOR B.                                    101000000101
A1 = A3 NOR B.                                    111000000101
A1 = A1 NAN B.                                    011001000101
A1 = A2 NAN B.                                    101001000101
A1 = A3 NAN B.                                    111001000101
      A1 = ONES.                                  001010000101
      A1 = A1F.                                   011010000101
      A1 = A2F.                                   101010000101
      A1 = A3F.                                   111010000101
A1 = A1 OR B.                                     011100000101
A1 = A2 OR B.                                     101100000101
A1 = A3 OR B.                                     111100000101
 A1 = A1 AND B.                                   011101000101
A1 = A2 AND B.                                    101101000101
A1 = A3 AND B.                                    111101000101
 A1 = A1 OR BF.                                   011110000101
A1 = A2 OR BF.                                    101110000101
A1 = A3 OR BF.                                    111110000101
A1 = A1 AND BF.                                   011111000101
A1 = A2 AND BF.                                   101111000101
A1 = A3 AND BF.                                   111111000101
      A2 = B + 1.                                 000000001001
A2 = A1 + B + 1.                                  010000001001
A2 = A2 + B + 1.                                  100000001001
A2 = A3 + B + 1.                                  110000001001
      A2 = B.                                     000001001001
```

```
A2 = A1 + B.                    0100010010G1
A2 = A2 + B.                    1000010010G1
A2 = A3 + B.                    1100010010G1
     A2 = 1.                    0000100010G1
A2 = A1 + 1.                    0100100010G1
A2 = A2 + 1.                    1000100010G1
A2 = A3 + 1.                    1100100010G1
     A2 = 0.                    0000110010G1
     A2 = A1.                   0100110010G1
     A2 = A2.                   1000110010G1
     A2 = A3.                   1100110010G1
     A2 = 0 EQV B.              0001000010G1
A2 = A1 EQV B.                  0101000010G1
A2 = A2 EQV B.                  1001000010G1
A2 = A3 EQV B.                  1101000010G1
A2 = A1 XOR B.                  0101010010G1
A2 = A2 XOR B.                  1001010010G1
A2 = A3 XOR B.                  1101010010G1
     A2 = BF + 1.               0001100010G1
A2 = A1 - B.                    0101100010G1
A2 = A2 - B.                    1001100010G1
A2 = A3 - B.                    1101100010G1
     A2 = BF.                   0001110010G1
A2 = A1 - B - 1.                0101110010G1
A2 = A2 - B - 1.                1001110010G1
A2 = A3 - B - 1.                1101110010G1
A2 = A1 NOR B.                  0110000010G1
A2 = A2 NOR B.                  1010000010G1
A2 = A3 NOR B.                  1110000010G1
A2 = A1 NAN B.                  0110010010G1
A2 = A2 NAN B.                  1010010010G1
A2 = A3 NAN B.                  1110010010G1
     A2 = ONES.                 0010100010G1
     A2 = A1F.                  0110100010G1
     A2 = A2F.                  1010100010G1
     A2 = A3F.                  1110100010G1
A2 = A1 OR B.                   0111000010G1
A2 = A2 OR B.                   1011000010G1
A2 = A3 OR B.                   1111000010G1
A2 = A1 AND B.                  0111010010G1
A2 = A2 AND B.                  1011010010G1
A2 = A3 AND B.                  1111010010G1
A2 = A1 OR BF.                  0111100010G1
A2 = A2 OR BF.                  1011100010G1
A2 = A3 OR BF.                  1111100010G1
A2 = A1 AND BF.                 0111110010G1
A2 = A2 AND BF.                 1011110010G1
A2 = A3 AND BF.                 1111110010G1
     A3 = B + 1.                0000000011G1
A3 = A1 + B + 1.                0100000011G1
A3 = A2 + B + 1.                1000000011G1
A3 = A3 + B + 1.                1100000011G1
     A3 = B.                    0000010011G1
A3 = A1 + B.                    0100010011G1
A3 = A2 + B.                    1000010011G1
A3 = A3 + B.                    1100010011G1
     A3 = 1.                    0000100011G1
A3 = A1 + 1.                    0100100011G1
A3 = A2 + 1.                    1000100011G1
```

```
A3 = A3 + 1.                    1100100001101
     A3 = 0.                    0000110011101
     A3 = A1.                   0100110011101
A3 = A2.                        1000110011101
A3 = A3.                        1100110011101
     A3 = 0 EQV B.              0001000011101
A3 = A1 EQV B.                  0101000011101
A3 = A2 EQV B.                  1001000011101
A3 = A3 EQV B.                  1101000011101
A3 = A1 XOR B.                  0101010011101
A3 = A2 XOR B.                  1001010011101
A3 = A3 XOR B.                  1101010011101
     A3 = BF + 1.               0001100011101
A3 = A1 - B.                    0101100011101
A3 = A2 - B.                    1001100011101
A3 = A3 - B.                    1101100011101
     A3 = BF.                   0001110011101
A3 = A1 -B - 1.                 0101110011101
A3 = A2 - B - 1.                1001110011101
A3 = A3 - B - 1.                1101110011101
A3 = A1 NOR B.                  0110000011101
A3 = A2 NOR B.                  1010000011101
A3 = A3 NOR B.                  1110000011101
A3 = A1 NAN B.                  0110010011101
A3 = A2 NAN B.                  1010010011101
A3 = A3 NAN B.                  1110010011101
A3 = ONES.                      0010100011101
     A3 = A1F.                  0110100011101
     A3 = A2F.                  1010100011101
     A3 = A3F.                  1110100011101
A3 = A1 OR B.                   0111000011101
A3 = A2 OR B.                   1011000011101
A3 = A3 OR B.                   1111000011101
A3 = A1 AND B.                  0111010011101
A3 = A2 AND B.                  1011010011101
A3 = A3 AND B.                  1111010011101
A3 = A1 OR BF.                  0111100011101
A3 = A2 OR BF.                  1011100011101
A3 = A3 OR BF.                  1111100011101
A3 = A1 AND BF.                 0111110011101
A3 = A2 AND BF.                 1011110011101
A3 = A3 AND BF.                 1111110011101
OUTO    = B + 1.                0000000010001
OUTO = A1 + B + 1.              0100000010001
OUTO = A2 + B + 1.              1000000010001
OUTO = A3 + B + 1.              1100000010001
OUTO    = B.                    0000101010001
OUTO = A1 + B.                  0100101010001
OUTO = A2 + B.                  1000101010001
OUTO = A3 + B.                  1100101010001
OUTO    = 1.                    0000100010001
OUTO    = A1 + 1.               0100100010001
OUTO    = A2 + 1.               1000100010001
OUTO    = A3 + 1.               1100100010001
OUTO    = 0.                    0000111010001
OUTO    = A1.                   0100111010001
OUTO    = A2.                   1000111010001
OUTO    = A3.                   1100111010001
OUTO    = 0 EQV B.              0001000010001
```

```
OUT0 = A1 EQV B.                    010100010001
OUT0 = A2 EQV B.                    100100010001
OUT0 = A3 EQV B.                    110100010001
OUT0 = A1 XOR B.                    010101010001
OUT0 = A2 XOR B.                    100101010001
OUT0 = A3 XOR B.                    110101010001
OUT0    = BF + 1.                   000110010001
OUT0 = A1 - B.                      010110010001
OUT0 = A2 - B.                      100110010001
OUT0 = A3 - B.                      110110010001
OUT0    = BF.                       000111010001
OUT0 = A1 - B - 1.                  010111010001
OUT0 = A2 - B - 1.                  100111010001
OUT0 = A3 - B - 1.                  110111010001
OUT0 = A1 NOR B.                    011000010001
OUT0 = A2 NOR B.                    101000010001
OUT0 = A3 NOR B.                    111000010001
OUT0 = A1 NAN B.                    011001010001
OUT0 = A2 NAN B.                    101001010001
OUT0 = A3 NAN B.                    111001010001
OUT0    = ONES.                     001010010001
OUT0    = A1F.                      011010010001
OUT0    = A2F.                      101010010001
OUT0    = A3F.                      111010010001
OUT0 = A1 OR B.                     011100010001
OUT0 = A2 OR B.                     101100010001
OUT0 = A3 OR B.                     111100010001
OUT0 = A1 AND B.                    011101010001
OUT0 = A2 AND B.                    101101010001
OUT0 = A3 AND B.                    111101010001
OUT0 = A1 OR BF.                    011110010001
OUT0 = A2 OR BF.                    101110010001
OUT0 = A3 OR BF.                    111110010001
OUT0 = A1 AND BF.                   011111010001
OUT0 = A2 AND BF.                   101111010001
OUT0 = A3 AND BF.                   111111010001
OUT1    = B + 1.                    000000010101
OUT1 = A1 + B + 1.                  010000010101
OUT1 = A2 + B + 1.                  100000010101
OUT1 = A3 + B + 1.                  110000010101
OUT1    = B.                        000001010101
OUT1 = A1 + B.                      010001010101
OUT1 = A2 + B.                      100001010101
OUT1 = A3 + B.                      110001010101
OUT1    = 1.                        000010010101
OUT1    = A1 + 1.                   010010010101
OUT1    = A2 + 1.                   100010010101
OUT1    = A3 + 1.                   110010010101
OUT1    = 0.                        000011010101
OUT1    = A1.                       010011010101
OUT1    = A2.                       100011010101
OUT1    = A3.                       110011010101
OUT1    = 0 EQV B.                  000100010101
OUT1 = A1 EQV B.                    010100010101
OUT1 = A2 EQV B.                    100100010101
OUT1 = A3 EQV B.                    110100010101
OUT1 = A1 XOR B.                    010101010101
OUT1 = A2 XOR B.                    100101010101
OUT1 = A3 XOR B.                    110101010101
```

OUT1 = BF + 1.	000110010101
OUT1 = A1 - B.	010110010101
OUT1 = A2 - B.	100110010101
OUT1 = A3 - B.	110110010101
OUT1 = BF.	000111010101
OUT1 = A1 - B - 1.	010111010101
OUT1 = A2 - B - 1.	100111010101
OUT1 = A3 - B - 1.	110111010101
OUT1 = A1 NOR B.	011000010101
OUT1 = A2 NOR B.	101000010101
OUT1 = A3 NOR B.	111000010101
OUT1 = A1 NAN B.	011001010101
OUT1 = A2 NAN B.	101001010101
OUT1 = A3 NAN B.	111001010101
OUT1 = ONES.	001010010101
OUT1 = A1F.	011010010101
OUT1 = A2F.	101010010101
OUT1 = A3F.	111010010101
OUT1 = A1 OR B.	011100010101
OUT1 = A2 OR B.	101100010101
OUT1 = A3 OR B.	111100010101
OUT1 = A1 AND B.	011101010101
OUT1 = A2 AND B.	101101010101
OUT1 = A3 AND B.	111101010101
OUT1 = A1 OR BF.	011110010101
OUT1 = A2 OR BF.	101110010101
OUT1 = A3 OR BF.	111110010101
OUT1 = A1 AND BF.	011111010101
OUT1 = A2 AND BF.	101111010101
OUT1 = A3 AND BF.	111111010101
OUT2 = B + 1.	000000011001
OUT2 = A1 + B + 1.	010000011001
OUT2 = A2 + B + 1.	100000011001
OUT2 = A3 + B + 1.	110000011001
OUT2 = B.	000001011001
OUT2 = A1 + B.	010001011001
OUT2 = A2 + B.	100001011001
OUT2 = A3 + B.	110001011001
OUT2 = 1.	000010011001
OUT2 = A1 + 1.	010010011001
OUT2 = A2 + 1.	100010011001
OUT2 = A3 + 1.	110010011001
OUT2 = 0.	000011011001
OUT2 = A1.	010011011001
OUT2 = A2.	100011011001
OUT2 = A3.	110011011001
OUT2 = 0 EQV B.	000100011001
OUT2 = A1 EQV B.	010100011001
OUT2 = A2 EQV B.	100100011001
OUT2 = A3 EQV B.	110100011001
OUT2 = A1 XOR B.	010101011001
OUT2 = A2 XOR B.	100101011001
OUT2 = A3 XOR B.	110101011001
OUT2 = BF + 1.	000110011001
OUT2 = A1 - B.	010110011001
OUT2 = A2 - B.	100110011001
OUT2 = A3 - B.	110110011001
OUT2 = BF.	000111011001
OUT2 = A1 - B - 1.	010111011001

```
OUT2 = A2 - B - 1.                          100111011001
OUT2 = A3 - B - 1.                          110111011001
OUT2 = A1 NOR B.                            011000011001
OUT2 = A2 NOR B.                            101000011001
OUT2 = A3 NOR B.                            111000011001
OUT2 = A1 NAN B.                            011001011001
OUT2 = A2 NAN B.                            101001011001
OUT2 = A3 NAN B.                            111001011001
OUT2    = ONES.                             001010011001
OUT2    = A1F.                              011010011001
OUT2    = A2F.                              101010011001
OUT2    = A3F.                              111010011001
OUT2 = A1 OR B.                             011100011001
OUT2 = A2 OR B.                             101100011001
OUT2 = A3 OR B.                             111100011001
OUT2 = A1 AND B.                            011101011001
OUT2 = A2 AND B.                            101101011001
OUT2 = A3 AND B.                            111101011001
OUT2 = A1 OR BF.                            011110011001
OUT2 = A2 OR BF.                            101110011001
OUT2 = A3 OR BF.                            111110011001
OUT2 = A1 AND BF.                           011111011001
OUT2 = A2 AND BF.                           101111011001
OUT2 = A3 AND BF.                           111111011001
OUT3 AMPCR = B + 1.                         000000011101
OUT3 AMPCR = A1 + B + 1.                    010000011101
OUT3 AMPCR = A2 + B + 1.                    100000011101
OUT3 AMPCR = A3 + B + 1.                    110000011101
OUT3 AMPCR = B.                             000001011101
OUT3 AMPCR = A1 + B.                        010001011101
OUT3 AMPCR = A2 + B.                        100001011101
OUT3 AMPCR = A3 + B.                        110001011101
OUT3 AMPCR = AMPCR + 1.                     000010011101
OUT3 AMPCR = A1 + AMPCR + 1.                010010011101
OUT3 AMPCR = A2 + AMPCR + 1.                100010011101
OUT3 AMPCR = A3 + AMPCR + 1.                110010011101
OUT3 AMPCR = AMPCR.                         000011011101
OUT3 AMPCR = A1 + AMPCR.                    010011011101
OUT3 AMPCR = A2 + AMPCR.                    100011011101
OUT3 AMPCR = A3 + AMPCR.                    110011011101
OUT3 AMPCR = 0 EQV B.                       000100011101
OUT3 AMPCR = A1 EQV B.                      010100011101
OUT3 AMPCR = A2 EQV B.                      100100011101
OUT3 AMPCR = A3 EQV B.                      110100011101
OUT3 AMPCR = A1 XOR B.                      010101011101
OUT3 AMPCR = A2 XOR B.                      100101011101
OUT3 AMPCR = A3 XOR B.                      110101011101
OUT3 AMPCR = BF + 1.                        000110011101
OUT3 AMPCR = A1 - B.                        010110011101
OUT3 AMPCR = A2 - B.                        100110011101
OUT3 AMPCR = A3 - B.                        110110011101
OUT3 AMPCR = BF.                            000111011101
OUT3 AMPCR = A1 - B - 1.                    010111011101
OUT3 AMPCR = A2 - B - 1.                    100111011101
OUT3 AMPCR = A3 - B - 1.                    110111011101
OUT3 AMPCR = A1 NOR B.                      011000011101
OUT3 AMPCR = A2 NOR B.                      101000011101
OUT3 AMPCR = A3 NOR B.                      111000011101
OUT3 AMPCR = ONES.                          001001011101
```

```
OUT3 AMPCR = A1 NAN B.                    011001011101
OUT3 AMPCR = A2 NAN B.                    101001011101
OUT3 AMPCR = A3 NAN B.                    111001011101
OUT3 AMPCR = NOT AMPCR.                   001010011101
OUT3 AMPCR = A1 NOR AMPCR.                011010011101
OUT3 AMPCR = A2 NOR AMPCR.                101010011101
OUT3 AMPCR = A3 NOR AMPCR.                111010011101
OUT3 AMPCR = A1 NAN AMPCR.                011011011101
OUT3 AMPCR = A2 NAN AMPCR.                101011011101
OUT3 AMPCR = A3 NAN AMPCR.                111011011101
OUT3 AMPCR = A1 OR B.                     011100011101
OUT3 AMPCR = A2 OR B.                     101100011101
OUT3 AMPCR = A3 OR B.                     111100011101
OUT3 AMPCR = A1 AND B.                    011101011101
OUT3 AMPCR = A2 AND B.                    101101011101
OUT3 AMPCR = A3 AND B.                    111101011101
OUT3 AMPCR = A1 OR BF.                    011110011101
OUT3 AMPCR = A2 OR BF.                    101110011101
OUT3 AMPCR = A3 OR BF.                    111110011101
OUT3 AMPCR = 0.                           001111011101
OUT3 AMPCR = A1 AND BF.                   011111011101
OUT3 AMPCR = A2 AND BF.                   101111011101
OUT3 AMPCR = A3 AND BF.                   111111011101
BEXO  R = B + 1.                          000000100001
BEXO R = A1 + B + 1.                      010000100001
BEXO R = A2 + B + 1.                      100000100001
BEXO R = A3 + B + 1.                      110000100001
BEXO  R = B.                              000001100001
BEXO R = A1 + B.                          010001100001
BEXO R = A2 + B.                          100001100001
BEXO R = A3 + B.                          110001100001
BEXO  R = 1.                              000010100001
BEXO  R = A1 + 1.                         010010100001
BEXO  R = A2 + 1.                         100010100001
BEXO  R = A3 + 1.                         110010100001
BEXO  R = 0.                              000011100001
BEXO  R = A1.                             010011100001
BEXO  R = A2.                             100011100001
BEXO  R = A3.                             110011100001
BEXO  R = 0 EQV B.                        000100100001
BEXO R = A1 EQV B.                        010100100001
BEXO R = A2 EQV B.                        100100100001
BEXO R = A3 EQV B.                        110100100001
BEXO R = A1 XOR B.                        010101100001
BEXO R = A2 XOR B.                        100101100001
BEXO R = A3 XOR B.                        110101100001
BEXO  R = BF + 1.                         000110100001
BEXO R = A1 - B.                          010110100001
BEXO R = A2 - B.                          100110100001
BEXO R = A3 - B.                          110110100001
BEXO  R = BF.                             000111100001
BEXO R = A1 - B - 1.                      010111100001
BEXO R = A2 - B - 1.                      100111100001
BEXO R = A3 - B - 1.                      110111100001
BEXO R = A1 NOR B.                        011000100001
BEXO R = A2 NOR B.                        101000100001
BEXO R = A3 NOR B.                        111000100001
BEXO R = A1 NAN B.                        011001100001
BEXO R = A2 NAN B.                        101001100001
```

```
REXO R = A3 NAN B.                    111001100001
REXO  R = ONES.                       001010100001
REXO R = A1F.                         011010100001
REXO R = A2F.                         101010100001
REXO R = A3F.                         111010100001
REXO R = A1 OR B.                     011100100001
REXO R = A2 OR B.                     101100100001
REXO R = A3 OR B.                     111100100001
REXO R = A1 AND B.                    011101100001
REXO R = A2 AND B.                    101101100001
REXO R = A3 AND B.                    111101100001
REXO R = A1 OR BF.                    011110100001
REXO R = A2 OR BF.                    101110100001
REXO R = A3 OR BF.                    111110100001
REXO R = A1 AND BF.                   011111100001
REXO R = A2 AND BF.                   101111100001
REXO R = A3 AND BF.                   111111100001
REX1 A1 = B + 1.                      000000100101
REX1 A1 = A1 + B + 1.                 010000100101
REX1 A1 = A2 + B + 1.                 100000100101
REX1 A1 = A3 + B + 1.                 110000100101
REX1 A1 = B.                          000001100101
REX1 A1 = A1 + B.                     010001100101
REX1 A1 = A2 + B.                     100001100101
REX1 A1 = A3 + B.                     110001100101
REX1 A1 = 1.                          000010100101
REX1 A1 = A1 + 1.                     010010100101
REX1 A1 = A2 + 1.                     100010100101
REX1 A1 = A3 + 1.                     110010100101
REX1 A1 = 0.                          000011100101
REX1 A1 = A1.                         010011100101
REX1 A1 = A2.                         100011100101
REX1 A1 = A3.                         110011100101
REX1 A1 = 0 EQV B.                    000100100101
REX1 A1 = A1 EQV B.                   010100100101
REX1 A1 = A2 EQV B.                   100100100101
REX1 A1 = A3 EQV B.                   110100100101
REX1 A1 = A1 XOR B.                   010110100101
REX1 A1 = A2 XOR B.                   100110100101
REX1 A1 = A3 XOR B.                   110110100101
REX1 A1 = BF + 1.                     000110100101
REX1 A1 = A1 - B.                     010111100101
REX1 A1 = A2 - B.                     100111100101
REX1 A1 = A3 - B.                     110111100101
REX1 A1 = BF.                         000111100101
REX1 A1 = A1 - B - 1.                 010111100101
REX1 A1 = A2 - B - 1.                 100111100101
REX1 A1 = A3 - B - 1.                 110111100101
REX1 A1 = A1 NOR B.                   011000100101
REX1 A1 = A2 NOR B.                   101000100101
REX1 A1 = A3 NOR B.                   111000100101
REX1 A1 = A1 NAN B.                   011001100101
REX1 A1 = A2 NAN B.                   101001100101
REX1 A1 = A3 NAN B.                   111001100101
REX1 A1 = ONES.                       001010100101
REX1 A1 = A1F.                        011010100101
REX1 A1 = A2F.                        101010100101
REX1 A1 = A3F.                        111010100101
REX1 A1 = A1 OR B.                    011100100101
```

```
BFX2 A2 = A2 OR BF.                    101110101001
BFX2 A2 = A3 OR BF.                    1111101 001
BFX2 A2 = A1 AND BF.                   011111101001
BFX2 A2 = A2 AND BF.                   101111101001
BFX2 A2 = A3 AND BF.                   111111101001
BFX3 A3 = B + 1.                       000000101101
BFX3 A3 = A1 + B + 1.                  010000101101
BFX3 A3 = A2 + B + 1.                  100000101101
BFX3 A3 = A3 + B + 1.                  110000101101
BFX3 A3 = B.                           000001101101
BFX3 A3 = A1 + B.                      010001101101
BFX3 A3 = A2 + B.                      100001101101
BFX3 A3 = A3 + B.                      110001101101
BFX3 A3 = 1.                           000010101101
BFX3 A3 = A1 + 1.                      010010101101
BFX3 A3 = A2 + 1.                      100010101101
BFX3 A3 = A3 + 1.                      110010101101
BFX3 A3 = 0.                           000011101101
BFX3 A3 = A1.                          010011101101
BFX3 A3 = A2.                          100011101101
BFX3 A3 = A3.                          110011101101
BFX3 A3 = 0 EQV B.                     000100101101
BFX3 A3 = A1 EQV B.                    010100101101
BFX3 A3 = A2 EQV B.                    100100101101
BFX3 A3 = A3 EQV B.                    110100101101
BFX3 A3 = A1 XOR B.                    010101101101
BFX3 A3 = A2 XOR B.                    100101101101
BFX3 A3 = A3 XOR B.                    110101101101
BFX3 A3 = BF + 1.                      000110101101
BFX3 A3 = A1 - B.                      010110101101
BFX3 A3 = A2 - B.                      100110101101
BFX3 A3 = A3 - B.                      110110101101
BFX3 A3 = BF.                          000111101101
BFX3 A3 = A1 - B -1.                   010111101101
BFX3 A3 = A2 - B - 1.                  100111101101
BFX3 A3 = A3 - B - 1.                  110111101101
BFX3 A3 = A1 NOR B.                    011000101101
BFX3 A3 = A2 NOR B.                    101000101101
BFX3 A3 = A3 NOR B.                    111000101101
BFX3 A3 = A1 NAN B.                    011001101101
BFX3 A3 = A2 NAN B.                    101001101101
BFX3 A3 = A3 NAN B.                    111001101101
BFX3 A3 = ONES.                        001010101101
BFX3 A3 = A1F.                         011010101101
BFX3 A3 = A2F.                         101010101101
BFX3 A3 = A3F.                         111010101101
BFX3 A3 = A1 OR B.                     011100101101
BFX3 A3 = A2 OR B.                     101100101101
BFX3 A3 = A3 OR B.                     111100101101
BFX3 A3 = A1 AND B.                    011101101101
BFX3 A3 = A2 AND B.                    101101101101
BFX3 A3 = A3 AND B.                    111101101101
BFX3 A3 = A1 OR BF.                    011110101101
BFX3 A3 = A2 OR BF.                    101110101101
BFX3 A3 = A3 OR BF.                    111110101101
BFX3 A3 = A1 AND BF.                   011111101101
BFX3 A3 = A2 AND BF.                   101111101101
BFX3 A3 = A3 AND BF.                   111111101101
BS = B + 1.                            000000110001
```

```
BS = A1 + B + 1.                                    010000110001
BS = A2 + B + 1.                                    100000110001
BS = A3 + B + 1.                                    110000110001
BS = B.                                             000001110001
BS = A1 + B.                                        010001110001
BS = A2 + B.                                        100001110001
BS = A3 + B.                                        110001110001
BS = 1.                                             000010110001
BS = A1 + 1.                                        010010110001
BS = A2 + 1.                                        100010110001
BS = A3 + 1.                                        110010110001
BS = 0.                                             000011110001
BS = A1.                                            010011110001
BS = A2.                                            100011110001
BS = A3.                                            110011110001
BS = 0 EQV B.                                       000100110001
BS = A1 EQV B.                                      010100110001
BS = A2 EQV B.                                      100100110001
BS = A3 EQV B.                                      110100110001
BS = A1 XOR B.                                      010101110001
BS = A2 XOR B.                                      100101110001
BS = A3 XOR B.                                      110101110001
BS = BF + 1.                                        000110110001
BS = A1 - B.                                        010110110001
BS = A2 - B.                                        100110110001
BS = A3 - B.                                        110110110001
BS = A1 - B - 1.                                    010111110001
BS = A2 - B - 1.                                    100111110001
BS = A3 - B - 1.                                    110111110001
BS = A1 NOR B.                                      011000110001
BS = A2 NOR B.                                      101000110001
BS = A3 NOR B.                                      111000110001
BS = A1 NAN B.                                      011001110001
BS = A2 NAN B.                                      101001110001
BS = A3 NAN B.                                      111001110001
BS = A1F.                                           011010110001
BS = A2F.                                           101010110001
BS = A3F.                                           111010110001
BS = ONES.                                          011011110001
BS = A1 OR B.                                       011100110001
BS = A2 OR B.                                       101100110001
BS = A3 OR B.                                       111100110001
BS = A1 AND B.                                      011101110001
BS = A2 AND B.                                      101101110001
BS = A3 AND B.                                      111101110001
BS = BF.                                            001110110001
BS = A1 OR BF.                                      011110110001
BS = A2 OR BF.                                      101110110001
BS = A3 OR BF.                                      111110110001
                BS = A1 AND BF.                     011111110001
BS = A2 AND BF.                                     101111110001
BS = A3 AND BF.                                     111111110001
A1S = B + 1.                                        000000110101
A1S = A1 + B + 1.                                   010000110101
A1S = A2 + B + 1.                                   100000110101
A1S = A3 + B + 1.                                   110000110101
A1S = B.                                            000001110101
A1S = A1 + B.                                       010001110101
A1S = A2 + B.                                       100001110101
```

```
A1S = A3 + B.                    1100011110101
A1S = 1.                         0000110110101
A1S = A1 + 1.                    0100110110101
A1S = A2 + 1.                    1000110110101
A1S = A3 + 1.                    1100110110101
A1S = 0.                         0000111110101
A1S = A1.                        0100111110101
A1S = A2.                        1000111110101
A1S = A3.                        1100111110101
A1S = 0 EQV B.                   0001001101 01
A1S = A1 EQV B.                  0101001101 01
A1S = A2 EQV B.                  1001001101 01
A1S = A3 EQV B.                  1101001101 01
A1S = A1 XOR B.                  0101011101 01
A1S = A2 XOR B.                  1001011101 01
A1S = A3 XOR B.                  1101011101 01
A1S = BF + 1.                    0001101101 01
A1S = A1 - B.                    0101101101 01
A1S = A2 - B.                    1001101101 01
A1S = A3 - B.                    1101101101 01
A1S = A1 - B - 1.                0101111101 01
A1S = A2 - B - 1.                1001111101 01
A1S = A3 - B - 1.                1101111101 01
A1S = A1 NOR B.                  0110001101 01
A1S = A2 NOR B.                  1010001101 01
A1S = A3 NOR B.                  1110001101 01
A1S = A1 NAN B.                  0110011101 01
A1S = A2 NAN B.                  1010011101 01
A1S = A3 NAN B.                  1110011101 01
A1S = A1F.                       0110101101 01
A1S = A2F.                       1010101101 01
A1S = A3F.                       1110101101 01
A1S = ONES.                      0110111101 01
A1S = A1 OR B.                   0111001101 01
A1S = A2 OR B.                   1011001101 01
A1S = A3 OR B.                   1111001101 01
A1S = A1 AND B.                  0111011101 01
A1S = A2 AND B.                  1011011101 01
A1S = A3 AND B.                  1111011101 01
A1S = BF.                        0011101101 01
A1S = A1 OR BF.                  0111101101 01
A1S = A2 OR BF.                  1011101101 01
A1S = A3 OR BF.                  1111101101 01
A1S = A1 AND BF.                 0111111101 01
A1S = A2 AND BF.                 1011111101 01
A1S = A3 AND BF.                 1111111101 01
A2S = B + 1.                     0000001110 01
A2S = A1 + B + 1.                0100001110 01
A2S = A2 + B + 1.                1000001110 01
A2S = A3 + B + 1.                1100001110 01
A2S = B.                         0000011110 01
A2S = A1 + B.                    0100011110 01
A2S = A2 + B.                    1000011110 01
A2S = A3 + B.                    1100011110 01
A2S = 1.                         0000101110 01
A2S = A1 + 1.                    0100101110 01
A2S = A2 + 1.                    1000101110 01
A2S = A3 + 1.                    1100101110 01
A2S = 0.                         0000111110 01
```

```
A2S = A1.                                   0100111111001
A2S = A2.                                   1000111111001
A2S = A3.                                   1100111111001
A2S = 0 EQV B.                              0000100111001
A2S = A1 EQV B.                             0101000111001
A2S = A2 EQV B.                             1001000111001
A2S = A3 EQV B.                             1101000111001
A2S = A1 XOR B.                             0100101111001
A2S = A2 XOR B.                             1001011111001
A2S = A3 XOR B.                             1101011111001
A2S = BF + 1.                               0001101111001
A2S = A1 - B.                               0101101111001
A2S = A2 - B.                               1001101111001
A2S = A3 - B.                               1101101111001
A2S = A1 - B - 1.                           0101111111001
A2S = A2 - B - 1.                           1001111111001
A2S = A3 - B - 1.                           1101111111001
A2S = A1 NOR B.                             0110001111001
A2S = A2 NOR B.                             1010001111001
A2S = A3 NOR B.                             1110001111001
A2S = A1 NAN B.                             0110011111001
A2S = A2 NAN B.                             1010011111001
A2S = A3 NAN B.                             1110011111001
A2S = A1F.                                  0110101111001
A2S = A2F.                                  1010101111001
A2S = A3F.                                  1110101111001
A2S = ONES.                                 0110111111001
A2S = A1 OR B.                              0111001111001
A2S = A2 OR B.                              1011001111001
A2S = A3 OR B.                              1111001111001
A2S = A1 AND B.                             0111011111001
A2S = A2 AND B.                             1011011111001
A2S = A3 AND B.                             1111011111001
A2S = BF.                                   0011101111001
A2S = A1 OR BF.                             0111101111001
A2S = A2 OR BF.                             1011101111001
A2S = A3 OR BF.                             1111101111001
A2S = A1 AND BF.                            0111111111001
A2S = A2 AND BF.                            1011111111001
A2S = A3 AND BF.                            1111111111001
A3 AMPCR = B + 1.                           0000001111101
A3 AMPCR = A1 + B + 1.                      0100001111101
A3 AMPCR = A2 + B + 1.                      1000001111101
A3 AMPCR = A3 + B + 1.                      1100001111101
A3 AMPCR = B.                               0000011111101
A3 AMPCR = A1 + B.                          0100011111101
A3 AMPCR = A2 + B.                          1000011111101
A3 AMPCR = A3 + B.                          1100011111101
A3 AMPCR = AMPCR + 1.                       0000101111101
A3 AMPCR = A1 + AMPCR + 1.                  0100101111101
A3 AMPCR = A2 + AMPCR + 1.                  1000101111101
A3 AMPCR = A3 + AMPCR + 1.                  1100101111101
A3 AMPCR = AMPCR.                           0000111111101
A3 AMPCR = A1 + AMPCR.                      0100111111101
A3 AMPCR = A2 + AMPCR.                      1000111111101
A3 AMPCR = A3 + AMPCR.                      1100111111101
A3 AMPCR = 0 EQV B.                         0000100111101
A3 AMPCR = A1 EQV B.                        0101000111101
A3 AMPCR = A2 EQV B.                        1001000111101
```

```
A3 AMPCR = A3 EQV B.                                  110100111101
A3 AMPCR = A1 XOR B.                                  010101111101
A3 AMPCR = A2 XOR B.                                  100101111101
A3 AMPCR = A3 XOR B.                                  110101111101
A3 AMPCR = BF + 1.                                    000110111101
A3 AMPCR = A1 - B.                                    010110111101
A3 AMPCR = A2 - B.                                    100110111101
A3 AMPCR = A3 - B.                                    110110111101
A3 AMPCR = BF.                                        000111111101
A3 AMPCR = A1 - B - 1.                                010111111101
A3 AMPCR = A2 - B - 1.                                100111111101
A3 AMPCR = A3 - B - 1.                                110111111101
A3 AMPCR = A1 NOR B.                                  011000111101
A3 AMPCR = A2 NOR B.                                  101000111101
A3 AMPCR = A3 NOR B.                                  111000111101
A3 AMPCR = ONES.                                      001001111101
A3 AMPCR = A1 NAN B.                                  011001111101
A3 AMPCR = A2 NAN B.                                  101001111101
A3 AMPCR = A3 NAN B.                                  111001111101
A3 AMPCR = NOT AMPCR.                                 001010111101
A3 AMPCR = A1 NOR AMPCR.                              011010111101
 3 AMPCR = A2 NOR AMPCR.                              101010111101
A3 AMPCR = A3 NOR AMPCR.                              111010111101
A3 AMPCR = A1 NAN AMPCR.                              011011111101
A3 AMPCR = A2 NAN AMPCR.                              101011111101
A3 AMPCR = A3 NAN AMPCR.                              111011111101
A3 AMPCR = A1 OR B.                                   011100111101
A3 AMPCR = A2 OR B.                                   101100111101
A3 AMPCR = A3 OR B.                                   111100111101
A3 AMPCR = A1 AND B.                                  011101111101
A3 AMPCR = A2 AND B.                                  101101111101
A3 AMPCR = A3 AND B.                                  111101111101
A3 AMPCR = A1 OR BF.                                  011110111101
A3 AMPCR = A2 OR BF.                                  101110111101
A3 AMPCR = A3 OR BF.                                  111110111101
A3 AMPCR = 0.                                         001111111101
A3 AMPCR = A1 AND BF.                                 011111111101
A3 AMPCR = A2 AND BF.                                 101111111101
A3 AMPCR = A3 AND BF.                                 111111111101
   SPARE CODE                                                  0010
   SPARE CODE                                                  1010
CALL LITERAL-DEFINE                                   XXXXXXXX0110
CPCR = LITERAL-DEFINE.                                XXXXXXXX0110
GOTO LITERAL-DEFINE                                   XXXXXXXX1110
MPCR = LITERAL-DEFINE.                                XXXXXXXX1110
LIT TO IR USED ONLY BY ASSEMBLER.                     XXXXXXXX0011
B = LITERAL-DEFINE.                                   XXXXXXXX1011
```

IF MST SET LC1 STEP.	000000000111
IF MST SET LC1 STEP ELSE JUMP.	000000001111
IF MST SET LC1 STEP ELSE SKIP.	000000010111
IF MST SET LC1 STEP ELSE EXEC.	000000011111
IF MST SET LC1 JUMP.	000000100111
IF MST SET LC1 JUMP ELSE JUMP.	000000101111
IF MST SET LC1 JUMP ELSE SKIP.	000000110111
IF MST SET LC1 JUMP ELSE EXEC.	000000111111
IF MST SET LC1 SKIP.	000001000111
IF MST SET LC1 SKIP ELSE JUMP.	000001001111
IF MST SET LC1 SKIP ELSE SKIP.	000001010111
IF MST SET LC1 SKIP ELSE EXEC.	000001011111
IF MST SET LC1 EXEC.	000001100111
IF MST SET LC1 EXEC ELSE JUMP.	000001101111
IF MST SET LC1 EXEC ELSE SKIP.	000001110111
IF MST SET LC1 EXEC ELSE EXEC.	000001111111
IF MST SET LC2 STEP.	000010000111
IF MST SET LC2 STEP ELSE JUMP.	000010001111
IF MST SET LC2 STEP ELSE SKIP.	000010010111
IF MST SET LC2 STEP ELSE EXEC.	000010011111
IF MST SET LC2 JUMP.	000010100111
IF MST SET LC2 JUMP ELSE JUMP.	000010101111
IF MST SET LC2 JUMP ELSE SKIP.	000010110111
IF MST SET LC2 JUMP ELSE EXEC.	000010111111
IF MST SET LC2 SKIP.	000011000111
IF MST SET LC2 SKIP ELSE JUMP.	000011001111
IF MST SET LC2 SKIP ELSE SKIP.	000011010111
IF MST SET LC2 SKIP ELSE EXEC.	000011011111
IF MST SET LC2 EXEC.	000011100111
IF MST SET LC2 EXEC ELSE JUMP.	000011101111
IF MST SET LC2 EXEC ELSE SKIP.	000011110111
IF MST SET LC2 EXEC ELSE EXEC.	000011111111
IF MST SET LC3 STEP.	000100000111
IF MST SET LC3 STEP ELSE JUMP.	000100001111
IF MST SET LC3 STEP ELSE SKIP.	000100010111
IF MST SET LC3 STEP ELSE EXEC.	000100011111
IF MST SET LC3 JUMP.	000100100111
IF MST SET LC3 JUMP ELSE JUMP.	000100101111
IF MST SET LC3 JUMP ELSE SKIP.	000100110111
IF MST SET LC3 JUMP ELSE EXEC.	000100111111
IF MST SET LC3 SKIP.	000101000111
IF MST SET LC3 SKIP ELSE JUMP.	000101001111
IF MST SET LC3 SKIP ELSE SKIP.	000101010111
IF MST SET LC3 SKIP ELSE EXEC.	000101011111
IF MST SET LC3 EXEC.	000101100111
IF MST SET LC3 EXEC ELSE JUMP.	000101101111
IF MST SET LC3 EXEC ELSE SKIP.	000101110111
IF MST SET LC3 EXEC ELSE EXEC.	000101111111
IF MST STEP.	000110000111
STEP.	000110000111
IF MST STEP ELSE JUMP.	000110001111
IF MST STEP ELSE SKIP.	000110010111
IF MST STEP ELSE EXEC.	000110011111
IF MST JUMP.	000110100111
IF MST JUMP ELSE JUMP.	000110101111
JUMP.	000110101111
IF MST JUMP ELSE SKIP.	000110110111
IF MST JUMP ELSE EXEC.	000110111111
IF MST SKIP.	000111000111

IF MST SKIP ELSE EXEC.	000111011111
IF MST EXEC.	000111100111
IF MST EXEC ELSE JUMP.	000111101111
IF MST EXEC ELSE SKIP.	000111110111
IF MST EXEC ELSE EXEC.	000111111111
EXEC.	000111111111
IF AOV SET LC1 STEP.	001000000111
IF AOV SET LC1 STEP ELSE JUMP.	001000001111
IF AOV SET LC1 STEP ELSE SKIP.	001000010111
IF AOV SET LC1 STEP ELSE EXEC.	001000011111
IF AOV SET LC1 JUMP.	001000100111
IF AOV SET LC1 JUMP ELSE JUMP.	001000101111
IF AOV SET LC1 JUMP ELSE SKIP.	001000110111
IF AOV SET LC1 JUMP ELSE EXEC.	001000111111
IF AOV SET LC1 SKIP.	001001000111
IF AOV SET LC1 SKIP ELSE JUMP.	001001001111
IF AOV SET LC1 SKIP ELSE SKIP.	001001010111
IF AOV SET LC1 SKIP ELSE EXEC.	001001011111
IF AOV SET LC1 EXEC.	001001100111
IF AOV SET LC1 EXEC ELSE JUMP.	001001101111
IF AOV SET LC1 EXEC ELSE SKIP.	001001110111
IF AOV SET LC1 EXEC ELSE EXEC.	001001111111
IF AOV SET LC2 STEP.	001010000111
IF AOV SET LC2 STEP ELSE JUMP.	001010001111
IF AOV SET LC2 STEP ELSE SKIP.	001010010111
IF AOV SET LC2 STEP ELSE EXEC.	001010011111
IF AOV SET LC2 JUMP.	001010100111
IF AOV SET LC2 JUMP ELSE JUMP.	001010101111
IF AOV SET LC2 JUMP ELSE SKIP.	001010110111
IF AOV SET LC2 JUMP ELSE EXEC.	001010111111
IF AOV SET LC2 SKIP.	001011000111
IF AOV SET LC2 SKIP ELSE JUMP.	001011001111
IF AOV SET LC2 SKIP ELSE SKIP.	001011010111
IF AOV SET LC2 SKIP ELSE EXEC.	001011011111
IF AOV SET LC2 EXEC.	001011100111
IF AOV SET LC2 EXEC ELSE JUMP.	001011101111
IF AOV SET LC2 EXEC ELSE SKIP.	001011110111
IF AOV SET LC2 EXEC ELSE EXEC.	001011111111
IF AOV SET LC3 STEP.	001100000111
IF AOV SET LC3 STEP ELSE JUMP.	001100001111
IF AOV SET LC3 STEP ELSE SKIP.	001100010111
IF AOV SET LC3 STEP ELSE EXEC.	001100011111
IF AOV SET LC3 JUMP.	001100100111
IF AOV SET LC3 JUMP ELSE JUMP.	001100101111
IF AOV SET LC3 JUMP ELSE SKIP.	001100110111
IF AOV SET LC3 JUMP ELSE EXEC.	001100111111
IF AOV SET LC3 SKIP.	001101000111
IF AOV SET LC3 SKIP ELSE JUMP.	001101001111
IF AOV SET LC3 SKIP ELSE SKIP.	001101010111
IF AOV SET LC3 SKIP ELSE EXEC.	001101011111
IF AOV SET LC3 EXEC.	001101100111
IF AOV SET LC3 EXEC ELSE JUMP.	001101101111
IF AOV SET LC3 EXEC ELSE SKIP.	001101110111
IF AOV SET LC3 EXEC ELSE EXEC.	001101111111
IF AOV STEP.	001110000111
IF AOV STEP ELSE JUMP.	001110001111
IF AOV STEP ELSE SKIP.	001110010111
IF AOV STEP ELSE EXEC.	001110011111

IF AOV JUMP,	001110100111
IF AOV JUMP ELSE JUMP,	001110101111
IF AOV JUMP ELSE SKIP,	001110110111
IF AOV JUMP ELSE EXEC,	001110111111
IF AOV SKIP,	001111000111
IF AOV SKIP ELSE JUMP,	001111001111
IF AOV SKIP ELSE SKIP,	001111010111
IF AOV SKIP ELSE EXEC,	001111011111
IF AOV EXEC,	001111100111
IF AOV EXEC ELSE JUMP,	001111101111
IF AOV EXEC ELSE SKIP,	001111110111
IF AOV EXEC ELSE EXEC,	001111111111
IF LST SET LC1 STEP,	010000000111
IF LST SET LC1 STEP ELSE JUMP,	010000001111
IF LST SET LC1 STEP ELSE SKIP,	010000010111
IF LST SET LC1 STEP ELSE EXEC,	010000011111
IF LST SET LC1 JUMP,	010000100111
IF LST SET LC1 JUMP ELSE JUMP,	010000101111
IF LST SET LC1 JUMP ELSE SKIP,	010000110111
IF LST SET LC1 JUMP ELSE EXEC,	010000111111
IF LST SET LC1 SKIP,	010001000111
IF LST SET LC1 SKIP ELSE JUMP,	010001001111
IF LST SET LC1 SKIP ELSE SKIP,	010001010111
IF LST SET LC1 SKIP ELSE EXEC,	010001011111
IF LST SET LC1 EXEC,	010001100111
IF LST SET LC1 EXEC ELSE JUMP,	010001101111
IF LST SET LC1 EXEC ELSE SKIP,	010001110111
IF LST SET LC1 EXEC ELSE EXEC,	010001111111
IF LST SET LC2 STEP,	010010000111
IF LST SET LC2 STEP ELSE JUMP,	010010001111
IF LST SET LC2 STEP ELSE SKIP,	010010010111
IF LST SET LC2 STEP ELSE EXEC,	010010011111
IF LST SET LC2 JUMP,	010010100111
IF LST SET LC2 JUMP ELSE JUMP,	010010101111
IF LST SET LC2 JUMP ELSE SKIP,	010010110111
IF LST SET LC2 JUMP ELSE EXEC,	010010111111
IF LST SET LC2 SKIP,	010011000111
IF LST SET LC2 SKIP ELSE JUMP,	010011001111
IF LST SET LC2 SKIP ELSE SKIP,	010011010111
IF LST SET LC2 SKIP ELSE EXEC,	010011011111
IF LST SET LC2 EXEC,	010011100111
IF LST SET LC2 EXEC ELSE JUMP,	010011101111
IF LST SET LC2 EXEC ELSE SKIP,	010011110111
IF LST SET LC2 EXEC ELSE EXEC,	010011111111
IF LST SET LC3 STEP,	010100000111
IF LST SET LC3 STEP ELSE JUMP,	010100001111
IF LST SET LC3 STEP ELSE SKIP,	010100010111
IF LST SET LC3 STEP ELSE EXEC,	010100011111
IF LST SET LC3 JUMP,	010100100111
IF LST SET LC3 JUMP ELSE JUMP,	010100101111
IF LST SET LC3 JUMP ELSE SKIP,	010100110111
IF LST SET LC3 JUMP ELSE EXEC,	010100111111
IF LST SET LC3 SKIP,	010101000111
IF LST SET LC3 SKIP ELSE JUMP,	010101001111
IF LST SET LC3 SKIP ELSE SKIP,	010101010111
IF LST SET LC3 SKIP ELSE EXEC,	010101011111
IF LST SET LC3 EXEC,	010101100111
IF LST SET LC3 EXEC ELSE JUMP,	010101101111
IF LST SET LC3 EXEC ELSE SKIP,	010101110111
IF LST SET LC3 EXEC ELSE EXEC,	010101111111

IF LST STEP.	010110000111
IF LST STEP ELSE JUMP.	010110001111
IF LST STEP ELSE SKIP.	010110010111
IF LST STEP ELSE EXEC.	010110011111
IF LST JUMP.	010110100111
IF LST JUMP ELSE JUMP.	010110101111
IF LST JUMP ELSE SKIP.	010110110111
IF LST JUMP ELSE EXEC.	010110111111
IF LST SKIP.	010111000111
IF LST SKIP ELSE JUMP.	010111001111
IF LST SKIP ELSE SKIP.	010111010111
IF LST SKIP ELSE EXEC.	010111011111
IF LST EXEC.	010111100111
IF LST EXEC ELSE JUMP.	010111101111
IF LST EXEC ELSE SKIP.	010111110111
IF LST EXEC ELSE EXEC.	010111111111
IF ABT SET LC1 STEP.	011000000111
IF ABT SET LC1 STEP ELSE JUMP.	011000001111
IF ABT SET LC1 STEP ELSE SKIP.	011000010111
IF ABT SET LC1 STEP ELSE EXEC.	011000011111
IF ABT SET LC1 JUMP.	011000100111
IF ABT SET LC1 JUMP ELSE JUMP.	011000101111
IF ABT SET LC1 JUMP ELSE SKIP.	011000110111
IF ABT SET LC1 JUMP ELSE EXEC.	011000111111
IF ABT SET LC1 SKIP.	011001000111
IF ABT SET LC1 SKIP ELSE JUMP.	011001001111
IF ABT SET LC1 SKIP ELSE SKIP.	011001010111
IF ABT SET LC1 SKIP ELSE EXEC.	011001011111
IF ABT SET LC1 EXEC.	011001100111
IF ABT SET LC1 EXEC ELSE JUMP.	011001101111
IF ABT SET LC1 EXEC ELSE SKIP.	011001110111
IF ABT SET LC1 EXEC ELSE EXEC.	011001111111
IF ABT SET LC2 STEP.	011010000111
IF ABT SET LC2 STEP ELSE JUMP.	011010001111
IF ABT SET LC2 STEP ELSE SKIP.	011010010111
IF ABT SET LC2 STEP ELSE EXEC.	011010011111
IF ABT SET LC2 JUMP.	011010100111
IF ABT SET LC2 JUMP ELSE JUMP.	011010101111
IF ABT SET LC2 JUMP ELSE SKIP.	011010110111
IF ABT SET LC2 JUMP ELSE EXEC.	011010111111
IF ABT SET LC2 SKIP.	011011000111
IF ABT SET LC2 SKIP ELSE JUMP.	011011001111
IF ABT SET LC2 SKIP ELSE SKIP.	011011010111
IF ABT SET LC2 SKIP ELSE EXEC.	011011011111
IF ABT SET LC2 EXEC.	011011100111
IF ABT SET LC2 EXEC ELSE JUMP.	011011101111
IF ABT SET LC2 EXEC ELSE SKIP.	011011110111
IF ABT SET LC2 EXEC ELSE EXEC.	011011111111
IF ABT SET LC3 STEP.	011100000111
IF ABT SET LC3 STEP ELSE JUMP.	011100001111
IF ABT SET LC3 STEP ELSE SKIP.	011100010111
IF ABT SET LC3 STEP ELSE EXEC.	011100011111
IF ABT SET LC3 JUMP.	011100100111
IF ABT SET LC3 JUMP ELSE JUMP.	011100101111
IF ABT SET LC3 JUMP ELSE SKIP.	011100110111
IF ABT SET LC3 JUMP ELSE EXEC.	011100111111
IF ABT SET LC3 SKIP.	011101000111
IF ABT SET LC3 SKIP ELSE JUMP.	011101001111
IF ABT SET LC3 SKIP ELSE SKIP.	011101010111
IF ABT SET LC3 SKIP ELSE EXEC.	011101011111

IF ABT SET LC3 EXEC.	011101100111
IF ABT SET LC3 EXEC ELSE JUMP.	011101101111
IF ABT SET LC3 EXEC ELSE SKIP.	011101110111
IF ABT SET LC3 EXEC ELSE EXEC.	011101111111
IF ABT STEP.	011110000111
IF ABT STEP ELSE JUMP.	011110001111
IF ABT STEP ELSE SKIP.	011110010111
IF ABT STEP ELSE EXEC.	011110011111
IF ABT JUMP.	011110100111
IF ABT JUMP ELSE JUMP.	011110101111
IF ABT JUMP ELSE SKIP.	011110110111
IF ABT JUMP ELSE EXEC.	011110111111
IF ABT SKIP.	011111000111
IF ABT SKIP ELSE JUMP.	011111001111
IF ABT SKIP ELSE SKIP.	011111010111
IF ABT SKIP ELSE EXEC.	011111011111
IF ABT EXEC.	011111100111
IF ABT EXEC ELSE JUMP.	011111101111
IF ABT EXEC ELSE SKIP.	011111110111
IF ABT EXEC ELSE EXEC.	011111111111
IF LC1 SET LC1 STEP.	100000000111
IF LC1 SET LC1 STEP ELSE JUMP.	100000001111
IF LC1 SET LC1 STEP ELSE SKIP.	100000010111
IF LC1 SET LC1 STEP ELSE EXEC.	100000011111
IF LC1 SET LC1 JUMP.	100000100111
IF LC1 SET LC1 JUMP ELSE JUMP.	100000101111
IF LC1 SET LC1 JUMP ELSE SKIP.	100000110111
IF LC1 SET LC1 JUMP ELSE EXEC.	100000111111
IF LC1 SET LC1 SKIP.	100001000111
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This publication is the Software Maintenance Manual for the Exploratory Systems Control Model (ESM). The software described is contained on four system tapes. Book 1 contains description, flowcharts, and listings for programs written in FORTRAN. Book 2 contains description, flowcharts, and listings for programs written in MDMPL Assemble Language. This manual was prepared by the Burroughs Corporation and is submitted in accordance with the requirements of contract DCA 100-75-C-0054.

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